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STADIA SURVEYING

THE

THEORY OF STADIA MEASUREMENTS,

Accompanied by Tables of Horizontal Distances and Differences of Level for the Reduction of Stadia Field Observations.

BY

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PREFACE.

THE rapid extension of the practice of stadia measurements has naturally created a demand for a guide to the method. The present hand-book contains a complete exposition of the theory, with directions for its application in the field. The tables for reduction of observations have been in use by the author on the Geological Survey of Pennsylvania.

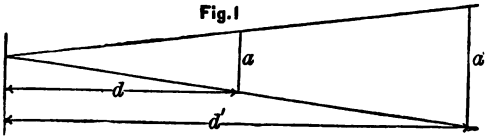
To increase the serviceableness of the book the trigonometrical four place tables have been added.

EDITOR OF MAGAZINE.

STADIA SURVEYING.*

THE fundamental principle upon which stadia measurements are based, is the geometrical one that the lengths of parallel lines subtending an angle are pro-

Fig. 1



portional to their distances from its apex. Thus if, in Fig. 1, a represents the

* The credit of having first introduced this method of measurement into this country would seem to belong to Mr. *John R. Mayer*, a French Swiss. It was used by him as early as 1850; and subsequently, during his connection with the United States Lake Survey, he did much towards perfecting the instruments and improving the methods of work. An essay by him in the *Journal Franklin Institute* for January, 1865, contains a short historical sketch of the development of topographical surveying and a brief discussion of the general principles of Stadia measurements.

length of a line subtending an angle at a distance d from its apex, and a' the length of line, parallel to and twice the length of a, subtending the same angle at a distance d' from its apex, then will d' equal $2d$.

This is, in a general way, the underlying principle of stadia work; the nature of the instruments used, however, introduces several modifications, and these will be best understood by a consideration of the conditions under which such measurements are generally made.

In the telescopes of most instruments fitted for stadia work, there are placed either two horizontal wires (usually adjustable) or a glass with two etched horizontal lines at the position of the cross wires, and equidistant from the center wire.

A self-reading stadia rod is further provided, graduated according to the units of measurement used.

In a horizontal sight with such a telescope and rod, the stadia wires seem to be projected upon the rod and to inter-

ept a distance which in Fig. 2 is repre-ented by a.

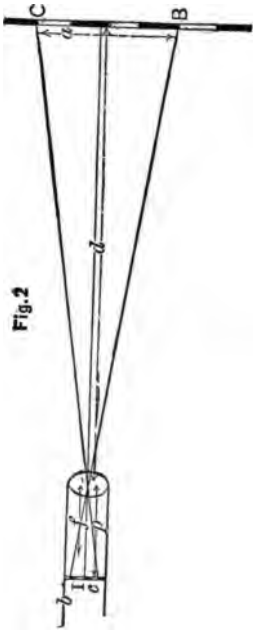


Fig. 2

In point of fact there is formed, at the position of the stadia wires, a small con-

jugate image of the rod which the wires intersect at points *b* and *c*, which are respectively the foci of the points B and C on the rod. If, for simplicity's sake, the object glass be considered a simple biconvex lens, then, by a principle of optics, the rays from any point of an object converge to a focus at such a position that a straight line, called a secondary axis, connecting the point with its image, passes through the *center* of the lens. This point of intersection of the secondary axes is called the optical center. Hence, it follows that lines such as *c* C and *b* B, in Fig. 2, drawn from the stadia wires through the centre of the object glass will intersect the rod at points corresponding to those which the wires cut on the *image* of the rod. From this follows the proportion:

$$\frac{d}{p}=\frac{a}{\mathrm{I}}\therefore d=\frac{p}{\mathrm{I}}a, \quad . \quad . \quad . \quad (1)$$

Where:

d=the distance of the rod from the center of the objective;

p=the distance of the stadia wires from the center of the objective;

a=the distance intercepted on the rod by the stadia wires;

I = the distance of the stadia wires apart.

If p remained the same for all lengths of sight, then $\frac{p}{I}$ could be made a desirable constant and d would be directly proportional to a. Unfortunately, however, for the simplicity of such measurements, p (the focal length) varies with the length of the sight, increasing as the distance diminishes and *vice versa*. Thus the proportionality between d and a is variable.

The object, then, is to determine exactly what function a is of d and to express the relation in some convenient formula.

The general formula for bi-convex lenses is:

$$\frac{1}{p}+\frac{1}{p'}=\frac{1}{f}. \quad . \quad . \quad . \quad (2)$$

f is the *principal* focal length of the lens, and p and p' are the focal distances of image and object, and are *approximately* the same as p and d, respectively, in equation (1):

$$\text{therefore, } \frac{1}{p}+\frac{1}{d}=\frac{1}{f}, \text{ approximately.}$$

$$\text{and } \frac{d}{p}=\frac{d}{f}-1$$

$$\text{From (1), } \frac{d}{p}=\frac{a}{I}$$

$$\therefore \frac{a}{I}=\frac{d}{f}-1$$

$$\text{whence } d=\frac{f}{I}a+f \quad . \quad . \quad . \quad (3)$$

In this formula, it will be noticed that, as f and I remain constant for sights of all lengths, the factor by which a is to be multiplied is a constant, and that d is thus equal to a constant times the length of a, plus f. This formula would seem, then, to express the relation desired, and it is generally considered as the fundamental one for stadia measurements. As above stated, however, the equation

$$\frac{1}{p}+\frac{1}{d}=\frac{1}{f}$$

is only *approximately* true and the conjunction of this formula with (1) being, therefore, not rigidly admissible, equation (3) does not express the exact relation.* The equation expressing the true relation, however, though differing from (3) in value, agrees with it in form and also in that the expression corresponding to $\frac{f}{I}$ is a constant and that the amount to be added remains, practically, f. The constant corresponding to $\frac{f}{I}$ may be called k† and thus the distance of the rod from the objective of the telescope is seen to be equal to a constant times the reading on the rod, plus the principal focal length of the objective. To obtain the exact distance to the *center* of the in-

*This is demonstrated on page 21.

†k is dependent upon I and can, therefore, be made a convenient value in any instrument fitted with adjustable stadia wires. It is generally made equal to 100, so that a reading on the rod of 1 corresponds to a distance of $100+f$.

strument, it is further necessary to add the distance of the objective from that centre, to f; which sum may be called c. The final expression for the distance with a horizontal sight, is then

$$d = ka + c \quad . \quad . \quad (4)$$

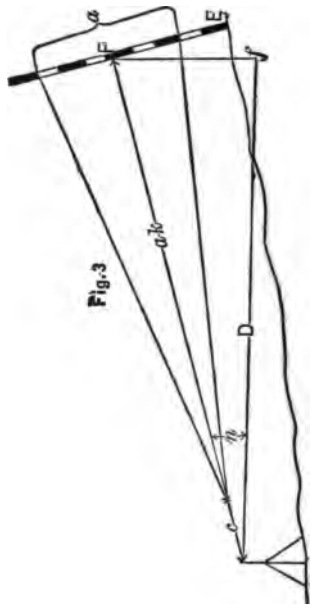
The necessity of adding c is somewhat of an incumbrance. In the stadia work of the United States Government surveys an approximate method is adopted in which the total distance is read directly from the rod. For this method the rod is arbitrarily graduated, so that, at the distance of an average sight, the same number of units of the graduation are intercepted between the stadia wires on the rod, as units of length are contained in the distance. For any other distance, however, this proportionality does not remain the same; for, according to the preceding demonstration, the reading on the rod is proportional to its distance, not from the center of the instrument, but from a point at a distance "c" in front of that center; so that,

when the rod is moved from the position where the reading expresses the *exact* distance to a point, say half that distance from the instrument center, the reading expresses a distance *less* than half; and, at a point double that distance from the instrument center, the distance expressed by the reading is *more* than twice the distance. The error for all distances less than the average being minus, and for greater distances plus. The method is, however, a close approximation, and excellent results are obtained by its use.

Another method of getting rid of the necessity of adding the constant was devised by *Mr. Porro*, a Piedmontese, who constructed an instrument in which there was such a combination of lenses in the objective, that the readings on the rod, for all lengths of sight, were exactly proportional to the distances.* The instru-

* A notice of this instrument will be found in an article by Mr. Benjamin Smith Lymon, entitled "Telescopic Measurements in Surveying," in *Jour. Franklin Inst.*, May and June, 1868, and a fuller description is contained in *Annales des Mines*, Vol. XVI, fourth series.

ment was, however, bulky and difficult to construct, and never came into extensive use.



For stadia measurements with inclined sights there are two modes of procedure.

One, is to hold the rod at right angles to the line of sight; the other, to hold it vertical. With the first method it will be seen by reference to Fig. 3, that the distance read is not to the foot of the rod, E, but to a point, *f*, vertically under the point, *F*, cut by the center wire. A correction has, therefore, to be made for this. An objection to this method is the difficulty of holding the rod at the same time in a vertical plane and inclined at a definite angle. Further, as the rod changes its inclination with each new position of the transit, the vertical angles of back and foresight are not measured from the same point.

The method usually adopted is the second, where the rod is always held *vertical*. Here, owing to the oblique view of the rod, it is evident that the space intercepted by the wires on the rod varies, not only with the distance, but also with the angle of inclination of the sight. Hence, in order to obtain the true distance from station to station, and also its vertical and horizontal components, a

correction must be made for this ob
view of the rod. In Fig. 4,

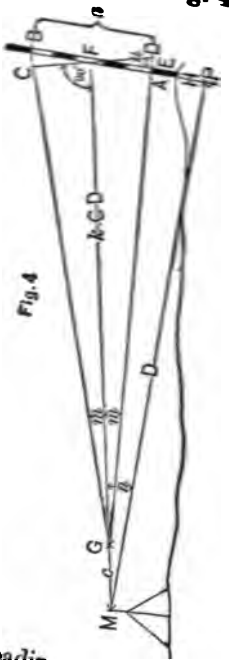


Fig. 4

$AB = a$ = the reading on the rod;
$MF = d$ = the inclined distance $= c + GF$
$= c + k\text{CD}$.

MP=D=the horizontal distance=$\frac{d}{\cos n}$,

FP=Q=the vertical distance=D tan n

n=the vertical angle,

AGB=$2m$.

It is first required to express d in terms of a, n and m.

From the proportionality existing between the sides of a triangle and the sides of the opposite angles,

$$\frac{AF}{GF}=\frac{\sin m}{\sin\ [90°+(n-m)]}$$

$$\text{or, } AF=GF \sin m \frac{1}{\cos\ (n-m)};$$

$$\text{and} \frac{BF}{GF}=\frac{\sin m}{\sin\ [90°-(n+m)]}$$

$$\text{or, } BF=GF \sin m \frac{1}{\cos\ (n+m)};$$

$$\therefore AF+BF=GF \sin m\left(\frac{1}{\cos\ (n-m)}+\frac{1}{\cos\ (n+m)}\right)$$

$$AF+BF=a, \text{ and } GF=\frac{CD}{2}\frac{1}{\tan m}$$

$$=\frac{CD\cos}{2\sin}$$

By substituting and reducing to a co
mon denominator,

$$a=\frac{CD}{2}\frac{\cos m\,[\cos(n+m)+\cos(n-m}{\cos(n+m)\cos(n-m)}$$

Reducing this according to trigon
metrical formulæ,

$$CD=a\frac{\cos^2 n\cos^2 m-\sin^2 n\sin^2 m}{\cos n\cos^2 m}$$

as $d=MF=c+k.CD$,

$$\therefore d=c+k\,a\frac{\cos^2 n\cos^2 m-\sin^2 n\sin^2}{\cos n\cos^2 m}$$

The horizontal distance, $D=d\cos n$.

$$\therefore D=c\cos n+ka\cos^2 n-k\,a\sin^2 n\tan^2$$

"The third member of this equati
may safely be neglected, as it is ve
small even for long distances and lar
angles of elevation (for 1500′, $n=45°$ a
$k=100$, it is but 0.07′.) Therefore, t
final formula for distances, with a stad

kept vertical, and with wires equidistant from the center wire, is the following:"

$$D = c \cos n + a k \cos^2 n \quad . \quad . \quad (5)$$

The vertical distance Q, is easily obtained from the relation: $Q = D \tan n$.

$$\therefore Q = c \sin n + a k \cos n \sin n$$

$$\text{or } Q = c \sin n + a k \frac{\sin 2n}{2} \quad . \quad (6)^*$$

With the aid of formulæ (5) and (6) the horizontal and vertical distances can be immediately calculated when the reading from a *vertical* rod, and the angle of elevation of any sight are given; and it is from these formulæ that I have calculated my stadia reduction tables. The values of $ak \cos^2 n$ and $ak\frac{\sin 2n}{2}$ were separately calculated for each two minutes up to 30 degrees of elevation; but, as the value of $c \sin n$ and $c \cos n$ have

* The above demonstration is substantially that given by Mr. George J. Specht, in an article on Topographical Surveying in *Van Nostrand's Engineering Magazine* for February, 1880, though enlarged and corrected.

quite an inappreciable variation fo
gree, it was thought sufficient
termine these values only for eac
gree. As c varies with different in
ments these last two expressions
calculated for three different values
thus furnishing a ratio from which va
of $c \sin n$ and $c \cos n$ can be easily de
mined for an instrument having any c
stant (c).

Similar tables have been computed b
J. A. Ockerson and *Jared Teeple*, of th
United States Lake Survey. Their us
is, however, limited, from the fact that
the meter is the unit of horizontal meas-
urement while the elevations are in feet.
The bulk of the tables furnish differences
of level for stadia readings up to 400
meters, but only up to 10° of elevation.
Supplementary tables give the elevations
up to 30° for a distance of one meter.
For obtaining horizontal distances refer-
ence has to be made to *another* table,
which is somewhat an objectionable fea-
ture, and a multiplication *and* a subtrac-
tion has to be made in order to obtain

the result. Last, but not least, these tables are, apparently, only accurate when used with an instrument whose constant is 0.43 meters.

As stated in the preceding discussion (p. 11), the generally accepted formula expressing the relation between the distance in a horizontal sight, the reading on the rod, the distance of the stadia wires apart, and the focal length of the objective is

$$d=\frac{f}{\mathrm{I}}\,a+f \quad . \quad . \quad . \quad (3)$$

where d, a, I and f represent these factors respectively.

This formula is derived from the conjunction of the two equations:

$$d=\frac{p}{\mathrm{I}}\,a; \quad . \quad . \quad . \quad . \quad (1)$$

$$\text{and}\ \frac{1}{p}+\frac{1}{p'}=\frac{1}{f}; \quad . \quad . \quad . \quad (2)$$

p and p in (2) being considered as equal to p and d in (1). p and d in (1), it will be remembered, are the distances from the *center* of the objective to the image

and object respectively. But *the* g[illegible] formula for lenses, (2), is derived on th[illegible] supposition that p and p' are measure[illegible] from the *exterior faces* of the lens, an[illegible] therefore p and d in (1) are each greater by half the thickness of the lens, than p and p' in (2). Further, this formula is derived on the supposition that the object glass of the telescope is a simple, biconvex lens, whereas, in fact, it is a compound lens composed of a plano concave and a biconvex lens. Now, though these points may seem insignificant in themselves, they may greatly influence the final result, as a difference of only 1 in the denominator of such a fraction as $\frac{1,000,000}{2}$ may alter the result by as much as 500,000. Considerable thought and time has, therefore, been given to the consideration of the effect of these corrections, and, as a result, it was found that the formula (3) does not express the true relation even within practical limits; and that if it were attempted to calculate the distance, d, by this formula, when

the factors f, p and a were given, a result would be obtained which would differ considerably from the real distance. The inaccuracy lies in the expression $\frac{f}{I}$. The one to be substituted for it is, however, like it, a constant for each instrument; and, as we determine the value of this constant by actual trial and not from a knowledge of the values of f and I, the correction to be made will not affect the practice.

Considering first the case of a telescope with a simple, biconvex lens, the optical center being, here, in the center of the lens, d and p, in equation (1), as before stated, are measured from the center of the lens, while, in equation (2), p and p' are measured from the exterior faces. If the thickness of the lens be taken as $2x$, then

p in equation (1)$=p$ in equation (2), minus x; and

p' in equation (1)$=$d in equation (2), minus x.

Therefore, while (1) remains

$$d=\frac{p}{\mathrm{I}}a, \text{ or } p=\frac{\mathrm{I}}{a}d \quad . \quad . \quad 1a$$

by substitution (2), becomes

$$\frac{\mathrm{I}}{p-x}+\frac{\mathrm{I}}{d-x}=\frac{\mathrm{I}}{f} \quad . \quad . \quad 2a$$

Substituting $d\frac{\mathrm{I}}{a}$ for p in (2a)

$$\frac{\mathrm{I}}{d\frac{\mathrm{I}}{a}-x}+\frac{1}{d-x}=\frac{1}{f}$$

$$\therefore d-x+d\frac{\mathrm{I}}{a}-x=\frac{1}{f}\left(d-x\right)\left(d\frac{\mathrm{I}}{a}-x\right)$$

$$=\frac{\mathrm{I}}{f}d^2\frac{\mathrm{I}}{a}-\frac{1}{f}d\frac{\mathrm{I}}{a}x-\frac{1}{f}dx+\frac{1}{f}x^2$$

whence, $-2x-\frac{1}{f}x^2=\frac{1}{f}d^2\frac{\mathrm{I}}{a}$

$$-d\frac{1}{f}x\left(\frac{\mathrm{I}}{a}+1\right)-d\left(\frac{\mathrm{I}}{a}+1\right)$$

or $\quad \frac{\mathrm{I}}{f}d^2\frac{\mathrm{I}}{a}-d\left\{\left(\frac{\mathrm{I}}{a}+1\right)\left(\frac{1}{f}x+1\right)\right\}.$

Multiplying both sides by $\frac{\mathrm{I}}{a}\frac{1}{f}$

$$-\frac{I}{a}\frac{1}{f}\left(2x+\frac{1}{f}x^2\right)=\frac{1}{f^2}d^2\frac{I^2}{a^2}$$

$$-\frac{I}{a}\frac{1}{f}d\left\{\left(\frac{I}{a}+1\right)\left(\frac{1}{f}x+1\right)\right\}$$

Adding to both sides $\frac{\left\{\left(\frac{I}{a}+1\right)\left(\frac{1}{f}x+1\right)\right\}}{2}$ squared,

$$\frac{\left\{\left(\frac{I}{a}+1\right)\left(\frac{1}{f}x+1\right)\right\}}{4}-\frac{I}{a}\frac{1}{f}\left(2x+\frac{1}{f}x^2\right)$$

$$=\left(d\frac{1}{f}\frac{I}{a}\right)^2-d\frac{1}{f}\frac{I}{a}$$

$$\left\{\left(\frac{I}{a}+1\right)\left(\frac{1}{f}x+1\right)\right\}\times\frac{\left\{\left(\frac{I}{a}+1\right)\left(\frac{1}{f}x+1\right)\right\}^2}{4}$$

Extracting the square root of both terms,

$$\sqrt{\frac{\left\{\left(\frac{I}{a}+1\right)\left(\frac{1}{f}x+1\right)\right\}^2}{4}}-\frac{1}{f}\frac{I}{a}\left(2x+\frac{1}{f}x^2\right)=d\frac{1}{f}\frac{I}{a}$$

$$-\frac{\left(\frac{I}{a}+1\right)\left(\frac{1}{f}x+1\right)}{2}$$

Therefore,

$$\left\{\sqrt{\frac{\left\{\left(\frac{I}{a}+1\right)\left(\frac{1}{f}x+1\right)\right\}^2}{4}-\frac{1}{f}\frac{I}{a}\left(2x+\frac{1}{f}x^2\right)}\right. \\ \left.+\frac{\left(\frac{I}{a}+1\right)\left(\frac{1}{f}x+1\right)}{2}\right\}\frac{af}{I}=k$$

$$\text{or, } d=\frac{(I+a)\,(x+f)}{2I} \\ +\sqrt{\frac{[(I+a)(x+f)]^2}{4I^2}-\frac{a}{I}(x^2+2xf)} \quad (3a)$$

This is the *exact* formula corresponding to (3), for biconvex lenses. This can, however, be considerably reduced without materially affecting its value. With a telescope of the dimensions of that of an ordinary engineer's transit, the term $\frac{a}{I}(x^2+2xf)$ diminishes the result by about $\frac{1}{8}$ of an inch and, therefore, may be neglected. Formula (3*a*), then becomes:

$$d=2\frac{(I+a)\,(x+f)}{2I}$$

$$= \frac{Ix + If + ax + af}{I}$$

$$= a\frac{x+f}{I} + f + x$$

The addition of x (half the thickness of the object glass) would be inappreciable in the length of any ordinary sight, and may be omitted. The final expression becomes, then,

$$d = \frac{x+f}{I}a + f \qquad (3b)$$

This formula, it will be observed, differs from (3) in that the reading on the rod (a), is multiplied by $x+f$ instead of f. The numerical difference between the results is seen in the following examples:

Consider first the case with a one-foot reading on the rod, and let $x = .18''$, $f = 9.00''$, and $I = .08''$.*

Formula (3) becomes, then:

$$d = \frac{9.00''}{.08''}\ 12.00'' + 9.00'' = 1359'' = 113.25';$$

* These are very closely the dimensions in Heller & Brightly's large Surveyor's Transit (5-inch needle), as kindly furnished me by Mr. Heller.

Formula (3b) becomes·

$$d=\frac{.18''+9.00''}{.08''}12.00''$$

$$+9.00''=1386=115.5'$$

Difference= 2.2'

When the reading on the rod is 5 feet (or 60'') then, (3) becomes:

$$d=\frac{9.00''}{.08''}60.00''+9.00=563.25';$$

and (3b) becomes:

$$d=\frac{.18''+9.00''}{.08''}60.00''+9.00=574.50'$$

Difference =11.25'*

The above demonstration shows, then, that, with a simple biconvex object glass, the usually accepted formula expressing the relation between the distance, the reading on the rod, the distance of the stadia wires apart, and the focal length of the objective, is not accurate even

* As the difference is evidently proportional to the length of sight, with a 1000' sight it would amount to 22.5', etc.

within the limits of accuracy of such measurements. With the usual combination of lenses in objectives this error would still remain. The derivation of a formula similar to (3*b*), for such lenses, would, however, be extremely difficult, and would only hold for the special lens in question. For, with such a combination of lenses, the optical center would no longer remain in the center of the lens, but would vary its position according to the relative thicknesses of the two glasses, their radii of curvature and their indices of refraction; and, after its position had been determined by abstruse calculation and refined experiment, its distance from the two exterior faces of the compound lens would be expressed by *two different* values (x and x') instead of two equal values (x); and this would very much complicate further calculation.

It was seen that, in the newly deduced formula, for biconvex objectives, like that heretofore accepted, the factor by which the reading on the rod is multiplied is a

constant for each instrument, and that the practical method of adjusting the instrument remains the same. The question now arises, does this remain the case with a compound objective?

In view of the difficulty of demonstrating this mathematically it was decided to make a practical test of this point with a carefully adjusted instrument. A distance of 500 feet was first measured off on a level stretch of ground, and each 50 foot point accurately located. From one end of this line three successive series of stadia readings* were then taken from the first 50 foot and each succeeding 100 foot mark. The following table contains the results:

* The readings were taken from two targets, set so that the sight should be horizontal and thus also preventing any personal error or prejudice from affecting the reading

Distances.	Spaces Intercepted on the Rod.			
	1st Series.	2d Series.	3d Series.	Mean.
Feet.	Feet.	Feet.	Feet.	Feet.
50.00	.4850	.4860	.4855	.4855
100.00	.9850	.9870	.9830	.9850
200.00	1.9850	1.9860	1.9840	1.9850
300.00	2.9890	2.9875	2.9870	2.9878
400.00	3.9830	3.9800	3.9890	3.9840
500 00	4.9850	4.9850	4.9900	4.9867

Multiplying the mean of these r
by 100, and subtracting the resu
the corresponding distance, we
the following table:

Distances.	Mean of Stadia Readings times 100.	Differences.	Variations from Mean.
Feet.	Feet.	Feet.	Feet.
50.00	48.55	1.45	+.02
100.00	98.50	1.50	+.07
200.00	198.50	1.50	+.07
300.00	298.78	1.22	−.21
400.00	398.40	1.60	+.17
500.00	498.67	1.33	−.10
	Sum of Differences = 8.60;		
	Mean of Differences = 1.43.		

The variations between the numbers of the column of differences are slight, the maximum from a mean value of 1.43 feet being only .21 feet. A study of the tables will show that these variations have no apparent relation to the length of the sight; in the maximum case, the variation corresponds to a reading on the rod of only .0021 feet (an amount much within the limits of accuracy of any ordinary sight). We are, therefore, perfectly justified in concluding that these variations are accidental, and that the "difference" is, for all practical purposes, a *constant* value.

We thus see that with a telescope having a compound, plano-convex objective, whatever the formula may be expressing the relation between d, f, x, etc., the horizontal distance is equal to a *constant* times the reading on the rod plus a *constant*, and may, as in the other cases, be expressed by the equation,

$$d = ak + c^*$$

* This may seem a statement of what was already a well-known fact. But, heretofore, it has been assumed to be a direct deduction from optical principles,

The many advantages of stadia measurements in surveying need not be dwelt upon here, both because attention has been repeatedly called to them, and because they are self-evident to every engineer. Neither will it be within the compass of this article to describe the various forms of rods and instruments, or the conventionalities of stadia work.

A few precautions, necessary for accurate work, should, however, be emphasized. First, as regards the special adjustments: care should be taken that in setting the stadia wires* allowance be

and as, according to the preceding article, this is not so clearly evident, it seemed necessary to redetermine the point.

* This applies to an instrument with movable stadia wires, and not to one with etched lines on glass. In the latter case the graduation of the rod is the adjustable portion. It has been claimed as an advantage for etched lines on glass, that they are not affected by variations of temperature while the distance between stadia wires is. A series of tests which I made with one of Heller & Brightly's transits, to determine this point, showed no appreciable alteration in the space between the wires, as measured on a rod 500 feet distant, with a range of temperature between that produced in the instrument by the sun of a hot summer's day, and that produced by enveloping the telescope in a bag of ice.

made for the instrument constant, and that the wires are so set that the reading, at any distance, is less than the true distance by the amount of this constant.*

For accurate stadia work it is better to take the reading for both distances and elevations only at alternate stations and then to take them from both back and fore sights, in such a manner that the vertical angle is always read from the same position on each rod, which should be the average height of the telescope at the different stations.

Cases will, of course, occur where this method will be impracticable, and then the mode of procedure must be left to the judgment of the surveyor. If it be desired to have the absolute elevation of the ground under the instrument, the height of the telescope at each station will have to be measured by the rod, and the difference between this measurement and the average height used in sighting to

* This is assuming the measurements to be made by the ordinary method, and not by the approximate one of the U. S. Engineers.

the rod either added or subtracted as the case may be. This difference will ordinarily be so small, that in a great deal of stadia work no reduction will be necessary. In sighting to the rod for the angle of depression or elevation, the center horizontal wire must always be used. By this means an exactly continuous line is measured.

For theoretical exactness it is necessary that the stadia wires should be equidistant from the horizontal center wire, for, if this be not the case, the distance read is for an angle of elevation differing from the true one by an amount proportional to the displacement of the wires.

With reasonable care a high degree of accuracy can be attained in stadia measurements. The common errors of stadia reading are unlike the common errors of chaining, the gross ones (such as making a difference of a whole hundred feet) being, in general, the only important ones, and these are readily checked by double readings. To facilitate the subtraction of the reading of one cross hair from that

of another, one should be put upon an even foot mark, and in the check reading the other one.

A general measure of the efficiency of stadia measurements is furnished in the professional papers of the Corps of Engineers, U. S. A., for 1882, on the Primary Triangulation of the Lake Survey, where it is stated that. in computing coördinates of stadia work for 1875, the average amount of discrepancy in 141 lines, varying between 965 and 6,648 meters (mean 2,450 meters) when compared with lines determined by triangulation or chaining, was found to be 1 in 649. The maximum limit of error is put at 1 in 300.

Mr. Benjamin Smith Lyman, who has made extensive use of stadia work both in this country and Japan, considers it decidedly more accurate than ordinary good chaining, if the gross errors be carefully avoided.

The results of stadia survey which have come to my notice fully support this view. During the past summer I had occasion to run a continuous stadia line

between two points some twelve miles apart. It was necessary that the position of these points with reference to each other should be determined as closely as possible with the means at hand. In consequence, the work was checked by taking duplicate vernier and stadia readings, and by taking a series of check sights to prominent objects. The latitudes and departures of this survey were afterwards calculated out, and the check angles computed and compared with those observed. The results are shown in the accompanying diagram and table. From the results of the tests tabulated on pp. 31, 32, Mr. Lyman has kindly furnished me with the following deductions, as an indication of the exactness of stadia measurements.*

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* I wish to take this opportunity to acknowledge my indebtedness to Mr. Benjamin Smith Lyman, for the kindly interest he has taken in the above discussion, for his valuable suggestions, and for his assistance in referring me to various sources for information.

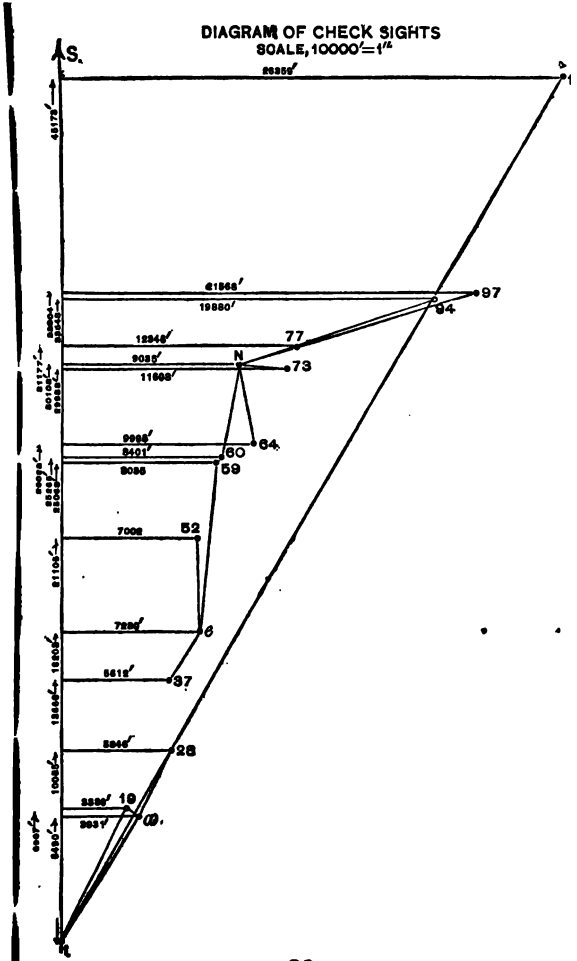
DIAGRAM OF CHECK SIGHTS
SCALE, 10000′=1″
S.
20350′
1
48172′
41968′
19880′
97
94
12348′
77
9035′
N
73
11888′
9995′
8401′
60
64
9095
59
7008
52
7220′
6
5612′
37
5840′
28
3330′
19
3837′
10
R

Table of Check Angles.

Sights.	Course as read.	Course as Deduced.	Difference.	Minimum Proportional Linear Displacement.
19—1	N. 26° 9′ E.	N. 26° 8′ E.	0° 1′	1.3′ E.
28—*a*	N. 28° 8′ E.	N. 28° 3′ E.	0° 5′	5.6′ E.
59—*e*	N. 5° 9′ E.	N. 5° 12′ E.	0° 3′	7.6′ W.
73—N	S. 87° 14′ E.	S. 87° 19′ E.	0° 5′	3.6′ S.
77—N	N. 72° 8′ E.	N. 72° 7′ E.	0° 1′	1.0′ S.
94—N	N. 72° 26′ E.	N. 72° 24′ E.	0° 2′	6.0′ S.
97—N	N. 73° 35′ E.	N. 73° 34′ E.	0° 1′	3.6′ S.

" Distances.	Variations from Mean.	Error (or Variation from Mean) in Parts of the Distance Measured.	Mean Magnitude.
50 feet.	+.07 −.03 +.02	+.0014 −.0006 +.0004	.0008
100 "	+.07 −.13 +.27	+.0007 −.0013 +.0027	.0016
200 "	+.07 −.03 +.17	+.00035 −.0015 +.00085	.00045
300 "	−.33 −.18 −.13	−.0011 −.0006 −.00043	.00071
400 "	+.27 +.57 −.33	+.000675 +.0014 −.00082	.000965
500 "	+.07 +.07 −.43	+.00014 +.00014 −.00086	.00038
	+.22 +.27 −.43=6		6).004905
			.000817

Taking the mean, 1.43, as exactly correct, we see, then, that the total error of the eighteen sights was only .06 feet, or $\frac{1}{77500}$ of the whole distance measured 4,650 feet, a precision (as it happens) seven times greater than I suggested in my paper for a telescope magnifying ten times. But the mean of the errors .000817 (or $\frac{1}{1224}$), which, so far as the insufficient number of eighteen sights can show, would be the mean of the errors of an infinite number of trials, would correspond to a probable error for any one of the number of trials (that is, in general) of the same kind, of .00069, or $\frac{1}{1450}$. This is within half the exactness I claimed as possible for the stadia in my paper. The difference may be due to several causes that I neglected to consider, such as a slight leaning of the rod forward or back, imperfect graduation of the rod, imperfect cleanliness or transparency of the glasses or of the air, imperfection in the shape of the lenses, or in their adjustments to one another, waviness from the varying refraction of the air with the

heat from the sun and the ground, inaccurate focussing, inexact placing of the center hair upon the center of the target or graduation. This last difficulty might be avoided by taking one edge of the upper or lower cross hairs, and by special painting of the target for the center hair.

* * * But at any rate the superior exactness of stadia measurement over chaining is shown, so far as eighteen trials could do it."

Tables of Horizontal Distances and Differences of Level for Stadia Measurements.

The formulæ used in the computation of the following tables, were those given by Mr. Geo. J. Specht in an article on Topographical Surveying, published in Van Nostrand's Engineering Magazine for February, 1880. These formulæ furnish expressions for horizontal distances and differences of level for stadia measurements with the conditions that the stadia rod *be held vertical*, and the stadia wires

be equidistant from the centre wire. They are as follows:

$D = c \cos n + ak \cos {}^2 n.$

$Q = D \tan n = c \sin n + \frac{ak \sin 2n.}{2}$

D=Horizontal distance.

Q=Difference of level.

c=the distance from the center of the instrument to the center of the object glass, plus the focal length of the object glass.

k=the focal length of the object glass divided by the distance of the stadia wires apart.

a=the reading on the stadia rod.

n=the vertical angle.

ak is the reading on the rod multiplied by k, which is a constant for each instrument (generally 100.) In the tables the vertical columns consist of two series of numbers for each degree, which series represent respectively the different values of $ak \cos {}^2 n$ and $\frac{ak \sin 2n}{2}$ for

every two minutes, when $ak=100$. To obtain the horizontal distance or the difference of level in any case, the corresponding value of $c \cos n$ or $c \sin n$ must further be added, and the mean of each of these expressions, for each degree, with 3 of the most common values of c, is given under each column.

As an example, let it be required to find the horizontal distance and the difference of level when, $n=+6°\ 18'$, $ak=570$, and the instrument constant, $c=.75$. In the column headed 6°, opposite 18′ in the series for "Hor. Dist.," we find 98.80 as the expression for $ak \cos^2 n$ when $ak=100$, therefore, when $ak=570$.

$ak \cos^2 n = 98.80 \times 5.70 = 563.16$.

To this must be added $c \cos n$, which in this case is found in the subjoined column to be .75.

$563.16 + .75 = 563.91$, which is the required horizontal distance.

In a similar manner,

$10.91 \times 5.70 + .08 = 62.27$ is the re-

quired difference of level. One multiplication and one addition must be made in each case.

It is to be noticed, that, with the smaller angles, cos n may be neglected in the expression c cos n, and c sin n may be entirely neglected without appreciable error.

For values of c which differ from those given, an approximate correction proportional to the amount of difference may very easily be made in these two expressions.

0°		1°		2°		3°	
Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.
100.00	.00	99.97	1.74	99.88	3.49	99.73	5.23
"	.06	"	1.80	99.87	3.55	99.72	5.28
"	.12	"	1.86	"	3.60	99.71	5.34
"	.17	99.96	1.92	"	3.66	"	5.40
"	.23	"	1.98	99.86	3.72	99.70	5.46
"	.29	"	2.04	"	3.78	99.69	5.52
"	.35	"	2.09	99.85	3.84	"	5.57
"	.41	99.95	2.15	"	3.90	99.68	5.63
"	.47	"	2.21	99.84	3.95	"	5.69
"	.52	"	2.27	"	4.01	99.67	5.75
"	.58	"	2.33	99.83	4.07	99.66	5.80
"	.64	99.94	2.38	"	4.13	"	5.86
"	.70	"	2.44	99.82	4.18	99.65	5.92
99.99	.76	"	2.50	"	4.24	99.64	5.98
"	.81	99.93	2.56	99.81	4.30	99.63	6.04
"	.87	"	2.62	"	4.36	"	6.09
"	.93	"	2.67	99.80	4.42	99.62	6.15
"	.99	"	2.73	"	4.48	"	6.21
"	1.05	99.92	2.79	99.79	4.53	99.61	6.27
"	1.11	"	2.85	"	4.59	99.60	6.33
"	1.16	"	2.91	99.78	4.65	99.59	6.38
"	1.22	99.91	2.97	"	4.71	"	6.44
99.98	1.28	"	3.02	99.77	4.76	99.58	6.50
"	1.34	99.90	3.08	"	4.82	99.57	6.56
"	1.40	"	3.14	99.76	4.88	99.56	6.61
"	1.45	"	3.20	"	4.94	"	6.67
"	1.51	99.89	3.26	99.75	4.99	99.55	6.73
"	1.57	"	3.31	99.74	5.05	99.54	6.78
99.97	1.63	"	3.37	"	5.11	99.53	6.84
"	1.69	99.88	3.43	99.73	5.17	99.52	6.90
"	1.74	"	3.49	"	5.23	99.51	6.96
.75	.01	.75	.02	.75	.03	.75	.05
1.00	.01	1.00	.03	1.00	.04	1.00	.06
1.25	.02	1.25	.03	1.25	.05	1.25	.08

M.	4°		5°		6°		
	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Ho Dis
0′....	99.51	6.96	99.24	8.68	98.91	10.40	98.
2.....	"	7.02	99.26	8.74	98.90	10.45	98.
4.....	99.50	7.07	99.22	8.80	98.88	10.51	98.
6.....	99.49	7.13	99.21	8.85	98.87	10.57	98.
8.....	99.48	7.19	99.20	8.91	98.86	10.62	98.
10.....	99.47	7.25	99.19	8.97	98.85	10.68	98.
12.....	99.46	7.30	99.18	9.03	98.83	10.74	98.
14.....	"	7.36	99.17	9.08	98.82	10.79	98.
16.....	99.45	7.42	99.16	9.14	98.81	10.85	98.
18.....	99.44	7.48	99.15	9.20	98.80	10.91	98.
20.....	99.43	7.53	99.14	9.25	98.78	10.96	98.
22.....	99.42	7.59	99.13	9.31	98.77	11.02	98.
24.....	99.41	7.65	99.11	9.37	98.76	11.08	98.
26.....	99.40	7.71	99.10	9.43	98.74	11.13	98.
28.....	99.39	7.76	99.09	9.48	98.73	11.19	98.
30.....	99.38	7.82	99.08	9.54	98.72	11.25	98.
32.....	99.38	7.88	99.07	9.60	98.71	11.30	98.
34.....	99.37	7.94	99.06	9.65	98.69	11.36	98.
36.....	99.36	7.99	99.05	9.71	98.68	11.42	98.
38.....	99.35	8.05	99.04	9.77	98.67	11.47	98.
40.....	99.34	8.11	99.03	9.83	98.65	11.53	98.
42.....	99.33	8.17	99.01	9.88	98.64	11.59	98.
44.....	99.32	8.22	99.00	9.94	98.63	11.64	98.
46.....	99.31	8.28	98.99	10.00	98.61	11.70	98.
48.....	99.30	8.34	98.98	10.05	98.60	11.76	98.
50.....	99.29	8.40	98.97	10.11	98.58	11.81	98.
52.....	99.28	8.45	98.96	10.17	98.57	11.87	98.
54.....	99.27	8.51	98.94	10.22	98.56	11.93	98.
56.....	99.26	8.57	98.93	10.28	98.54	11.98	98.
58.....	99.25	8.63	98.92	10.34	98.53	12.04	98.
60.....	99.24	8.68	98.91	10.40	98.51	12.10	98.
c= .75	.75	.06	.75	.07	.75	.08	.
c=1.00	1.00	.08	.99	.09	.99	.11	.
c=1.25	1.25	.10	1.24	.11	1.24	.14	1.

	8°		9°		10°		11°	
	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.
.	98.06	13.78	97.55	15.45	96.98	17.10	96.36	18 73
.	98.05	13.84	97.53	15.51	96.96	17.16	96.34	18.78
.	98.03	13.89	97.52	15.56	96.94	17.21	96.32	18.84
	98.01	13.95	97.50	15.62	96.92	17.26	96.29	18 89
.	98.00	14.01	97.48	15.67	96.90	17.32	96.27	18.95
.	97.98	14.06	97.46	15.73	96.88	17.37	96.25	19 00
.	97.97	14.12	97.44	15.78	96.86	17.43	96.23	19.05
.	97.95	14.17	97.43	15.84	96.84	17.48	96.21	19.11
.	97.93	14.23	97.41	15 89	96.82	17.54	96.18	19.16
.	97.92	14.28	97.39	15.95	96.80	17.59	96.16	19.21
..	97.90	14.34	97 37	16 00	96.78	17.65	96.14	19.27
.	97.88	14.40	97.35	16.06	96.76	17.70	96.12	19.32
..	97.87	14.45	97.33	16.11	96.74	17.76	96.09	19.38
..	97.85	14.51	97.31	16.17	96.72	17.81	96.07	19.43
	97.83	14.56	97.29	16.22	96.70	17.86	96.05	19.48
..	97.82	14.62	97.28	16.28	96.68	17.92	96.03	19.54
..	97.80	14.67	97.26	16.33	96.66	17.97	96.00	19.59
..	97.78	14.73	97.24	16.39	96.64	18.03	95.98	19.64
..	97.76	14.79	97.22	16.44	96.62	18.08	95.96	19.70
..	97.75	14.84	97.20	16.50	96.60	18.14	95.93	19.75
..	97.73	14.90	97.18	16.55	96.57	18.19	95.91	19.80
..	97.71	14.59	97.16	16.61	96.55	18.24	95.89	19.86
..	97.69	15.01	97.14	16.66	96.53	18.30	95.86	19.91
..	97.68	15.06	97.12	16.72	96.51	18.35	95.84	19.96
	97.66	15.12	97.10	16.77	96.49	18.41	95.82	20.02
..	97.64	15.17	97.08	16.83	96.47	18.46	95.79	20.07
..	97.62	15.23	97.06	16.88	96.45	18.51	95.77	20.12
..	97.61	15.28	97.04	16.94	96.42	18.57	95.75	20.18
.	97.59	15.34	97.02	16.99	96.40	18.62	95.72	20.23
.	97.57	15.40	97.00	17.05	96.38	18.68	95.70	20.28
..	97.55	15.45	96.98	17.10	96.36	18.73	95.68	20.34
'5	.74	.11	.74	.12	.74	.14	.73	.15
0	.99	.15	.99	.16	.98	.18	.98	.20
5	1.23	.18	1.23	.21	1.23	.23	1.22	.25

M.	12°		13°		14°		15°	
	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	D E
0′....	95.68	20.34	94.94	21.92	94.15	23.47	93.30	2
2.....	95.65	20.39	94.91	21.97	94.12	23.52	93.27	2
4.....	95.68	20.44	94.89	22.02	94.09	23.58	93.24	2
6.....	95.61	20.50	94 86	22.08	94.07	23.63	93.21	2
8.....	95.58	20.55	94.84	22.13	94.04	23.68	93.18	2
10.....	95.56	20.60	94.81	22.18	94.01	23.73	93.16	2
12.....	95.53	20.66	94.79	22.23	93.98	23.78	93.13	2
14.....	95.51	20.71	94.76	22.28	93.95	23.83	93.10	2
16.....	95.49	20.76	94.73	22.34	93.93	23.88	93.07	2
18. ...	95.46	20.81	94.71	22.39	93.90	23.93	93.04	2
20.....	95.44	20.87	94.68	22.44	93.87	23.99	93.01	2
22.....	95.41	20.92	94.66	22.49	93.84	24.04	92.98	2
24.....	95.39	20.97	94.63	22.54	93.81	24.09	92.95	2
26.....	95.36	21.03	94.60	22.60	93.79	24.14	92.93	2
28. ...	95.34	21.08	94.58	22.65	93.76	24.19	92.89	2
30.....	95.32	21.13	94.55	22.70	93.73	24.24	92.86	2
32.....	95.29	21.18	94.52	22.75	93.70	24.29	92.83	2
34.....	95.27	21.24	94.50	22.80	93.67	24.34	92.80	2
36.....	95.24	21.29	94.47	22.85	93.65	24.39	92.77	2
38.....	95.22	21.34	94.44	22.91	93.62	24.44	92.74	2
40.....	95.19	21.39	94.42	22.96	93.59	24.49	92.71	2
42.....	95.17	21.45	94.39	23.01	93.56	24.55	92.68	2
44.....	95.14	21.50	94.36	23.06	93.53	24.60	92.65	2
46.....	95.12	21.55	94.34	23.11	93.50	24.65	92.62	2
48.....	95.09	21.60	94.31	23.16	93.47	24.70	92.59	2
50.....	95.07	21.66	94.28	23.22	93.45	24.75	92.56	2
52.....	95.04	21.71	94.26	23.27	93.42	24.80	92.53	2
54.....	95.02	21.76	94.23	23.32	93.39	24.85	92.49	2
56.....	94.99	21.81	94.20	23.37	93.36	24.90	92.46	2
58.....	94.97	21.87	94.17	23.42	93.33	24.95	92.43	2
60.....	94.94	21.92	94.15	23.47	93.30	25.00	92.40	2
c= .75	.73	.16	.73	.17	.73	.19	.72	
c=1 00	.98	.22	.97	.23	.97	.25	.96	
c=1.25	1.22	.27	1.21	.29	1.21	.31	1.20	

16°		17°		18°		19°	
Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.
92.40	26.50	91.45	27.96	90.45	29.39	89.40	30.78
92.37	26.55	91.42	28.01	90.42	29.44	89.36	30.83
92.34	26.59	91.39	28.06	90.38	29.48	89.33	30.87
92.31	26.64	91.35	28.10	90.35	29.53	89.29	30.92
92.28	23.69	91.32	28.15	90.31	29.58	89.26	30.97
92.25	26.74	91.29	28.20	90.28	29.62	89.22	31.01
92.22	26.79	91.26	28.25	90.24	29.67	89.18	31.06
92.19	26.84	91.22	28.30	90.21	29.72	89.15	31.10
92.15	26.89	91.19	28.34	90.18	29.76	89.11	31.15
92.12	26.94	91.16	28.39	90.14	29.81	89.08	31.19
92.09	26.99	91.12	28.44	90.11	29.86	89.04	31.24
92.06	27.04	91.09	28.49	90.07	29.90	89.00	31.28
92.03	27.09	91.06	28.54	90.04	29.95	88.96	31.33
92.00	27.13	91.02	28.58	90.00	30.00	88.93	31.38
91.97	27.18	90.99	28.63	89.97	30.04	88 89	31.42
91.93	27.23	90.96	28.68	89.93	30.09	88.86	31.47
91.90	27.28	90.92	28.73	89.90	30.14	88.82	31.51
91.87	27.33	90.89	28.77	89.86	30.19	88.78	31.56
91.84	27.38	90 86	28.82	89.83	30.23	88.75	31.60
91.81	27.43	90.82	28.87	89.79	30.28	88.71	31.65
91.77	27.48	90.79	28.92	89.76	30.32	88.67	31 69
91.74	27.52	90.76	28.96	89.72	30.37	88.64	31.74
91.71	27.57	90.72	29.01	89.69	30.41	88.60	31.78
91.68	27.62	90.69	29.06	89.65	30.46	88.56	31.83
91.65	27.67	90.66	29.11	89.61	30.51	88.53	31.87
91.61	27.72	90.62	29.15	89.58	30.55	88.49	31.92
91.58	27.77	90.59	29.20	89.54	30.60	88.45	31.96
91.55	27.81	90.55	29.25	89.51	30.65	88.41	32.01
91.52	27.86	90.52	29.30	89.47	30.69	88.38	32.05
91.48	27.91	90.48	29.34	89.44	30.74	88.34	32.09
91.45	27.96	90.45	29.39	89.40	30.78	88.30	32.14
.72	.21	.72	.23	.71	.24	.71	.25
.96	.28	.95	.30	.95	.32	.94	.33
1.20	.36	1.19	.38	1.19	.40	1.18	.42

M.	20°		21°		22°		23°	
	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dis.	Diff. Elev.	Hor. Dist.	Diff. Elev.
0'....	88.30	32.14	87.16	33.46	85.97	34.73	84.73	
2.....	88.26	32.18	87.12	33.50	85.93	34.77	84.69	
4.....	88.23	32.23	87.08	33.54	85.89	34.82	84.65	
6.....	88.19	32.27	87.04	33.59	85.85	34.86	84.61	
8.....	88.15	32.32	87.00	33.63	85.80	34.90	84.57	
10.....	88.11	32.36	86.96	33.67	85.76	34.94	84.52	
12.....	88.08	32.41	86.92	33.72	85.72	35.98	84.48	
14.....	88.04	32.45	86.88	33.76	85.68	35.02	84.44	
16.....	88.00	32.49	86.84	33.80	85.64	35.07	84.40	
18.....	87.96	32.54	86.80	33.84	85.60	35.11	84.35	
20.....	87.93	32.58	86.77	33.89	85.56	35.15	84.31	
22.....	87.89	32.63	86.73	33.93	85.52	35.19	84.27	
24.....	87.85	32.67	86.69	33.97	85.48	35.23	84.23	
26.....	87.81	32.72	86.65	34.01	85:44	35 27	84.18	
28.....	87.77	32.76	86.61	34.06	85.40	35.31	84.14	
30.....	87.74	32.80	86.57	34.10	85.36	35.36	84.10	
32.....	87.70	32.85	86.53	34.14	85.31	35.40	84.06	
34.....	87.66	32.89	86.49	34.18	85.27	35.44	84.01	
36.....	87.62	32.93	86.45	34.23	85.23	35.48	83.97	
38.....	87.58	32.98	86.41	34.27	85.19	35.52	83.93	
40.....	87.54	33.02	86.37	34.31	85.15	35.56	83.89	
42.....	87.51	33.07	86.33	34.35	85.11	35.60	83.84	
44.....	87.47	33.11	86.29	34.40	85.07	35.64	83.80	
46.....	87.43	33.15	86.25	34.44	85.02	35.68	83.76	
48.....	87.39	33.20	86.21	34.48	84.98	35.72	83.72	
50.....	87.35	33.24	86.17	34.52	84.94	35.76	83.67	
52.....	87.31	33.28	86.13	34.57	84.90	35.80	83.63	
54.....	87.27	33.33	86.09	34.61	84.86	35.85	83.59	
56.....	87.24	33.37	86.05	34.65	84.82	35.89	83.54	
58.....	87.20	33.41	86.01	34.69	84.77	35.93	83.50	
60.....	87.16	33.46	85.97	34.73	84.73	35.97	83.46	
$c = .75$	.70	.26	.70	.27	.69	.29	.69	
$c = 1.00$	.94	.35	.93	.37	.92	.38	.92	
$c = 1.25$	1.17	.44	1.16	.46	1.15	.48	1.15	

24°		25°		26°		27°	
Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.
83.46	37.16	82.14	38.30	80.78	39.40	79.39	40.45
83.41	37.20	82.09	38.34	80.74	39.44	79.34	40.49
83.37	37.23	82.05	38.38	80.69	39.47	79.30	40.52
83.33	37.27	82.01	38.41	80.65	39.51	79.25	40.55
83.28	37.31	81.96	38.45	80.60	39.54	79.20	40.59
83.24	37.35	81.92	38.49	80.55	39.58	79.15	40.62
83.20	37.39	81.87	38.53	80.51	39.61	79.11	40.66
83.15	37.43	81.83	38.56	80.46	39.65	79.06	40.69
83.11	37.47	81.78	38.60	80.41	39.69	79.01	40.72
83.07	37.51	81.74	38.64	80.37	39.72	78.96	40.76
83.02	37.54	81.69	38.67	80.32	39.76	78.92	40.79
82.98	37.58	81.65	38.71	80.28	39.79	78.87	40.82
82.93	37.62	81.60	38.75	80.23	39.83	78.82	40.86
82.89	37.66	81.56	38.78	80.18	39.86	78.77	40.89
82.85	37.70	81.51	38.82	80.14	39.90	78.73	40.92
82.80	37.74	81.47	38.86	80.09	39.93	78.68	40.96
82.76	37.77	81.42	38.89	80.04	39.97	78.63	40.99
82.72	37.81	81.38	38.93	80.00	40.00	78.58	41.02
82.67	37.85	81.33	38.97	79.95	40.04	78.54	41.06
82 63	37.89	81.28	39.00	79.90	40.07	78.49	41.09
82.58	37.93	81.24	39.04	79.86	40.11	78.44	41.12
82.54	37.96	81.19	39.08	79.81	40.14	78.39	41.16
82.49	38.00	81.15	39.11	79.76	40.18	78.34	41.19
82.45	38.04	81.10	39.15	79.72	40.21	78.30	41.22
82 41	38.08	81.06	39.18	79.67	40.24	78.25	41.26
82.36	38.11	81.01	39.22	79.62	40.28	78.20	41.29
82.32	38.15	80.97	39.26	79.58	40.31	78.15	41.32
82.27	38.19	80.92	39.29	79.53	40.35	78.10	41.35
82.23	38.23	80.87	39.33	79.48	40.38	78.06	41.39
82.18	38.26	80.83	39.36	79.44	40.42	78.01	41.42
82.14	38.30	80.78	39.40	79.39	40.45	77.96	41.45
.68	.31	.68	.32	.67	.33	.66	.35
.91	.41	.90	.43	.89	.45	.89	.46
1.14	.52	1.13	.54	1.12	.56	1.11	.58

M.	28°		29°		30°	
	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.
0′....	77.96	41.45	76.50	42.40	75.00	43.30
2.....	77.91	41.48	76.45	42.43	74.95	43.33
4.....	77.86	41.52	76.40	42.46	74.90	43.36
6.....	77.81	41.55	76.35	42.49	74.85	43.39
8.....	77.77	41.58	76.30	42.53	74.80	43.42
10.....	77.72	41.61	76.25	42.56	74.75	43.45
12.....	77.67	41.65	76.20	42.59	74.70	43.47
14.....	77.62	41.68	76.15	42.62	74.65	43.50
16.....	77.57	41.71	76.10	42.65	74.60	43.53
18.....	77.52	41.74	76.05	42.68	74.55	43.56
20.....	77.48	41.77	76.00	42.71	74.49	43.59
22.....	77.42	41.81	75.95	42.74	74.44	43.62
24.....	77.38	41.84	75.90	42.77	74.39	43.65
26.....	77.33	41.87	75.85	42.80	74.34	43.67
28.....	77.28	41.90	75.80	42.83	74.29	43.70
30.....	77.23	41.93	75.75	42.86	74.24	43.73
32.....	77.18	41.97	75.70	42.89	74.19	43 76
34.....	77.13	42.00	75.65	42 92	74.14	43.79
36.....	77.09	42 03	75.60	42.95	74.09	43.82
38.....	77.04	42.06	75.55	42.98	74.04	43.84
40.....	76.99	42.09	75.50	43.01	73.99	43.87
42.....	76.94	42.12	75.45	43.04	73.93	43.90
44.....	76.89	42.15	75.40	43.07	73.88	43.93
46.....	76.84	42.19	75.35	43.10	73.83	43.95
48....	76.79	42.22	75.30	43.13	73.78	43.98
50.....	76.74	42.25	75.25	43.16	73.73	44.01
52.....	76.69	42.28	75.20	43.18	73.68	44.04
54.....	76.64	42.31	75.15	42.21	73.63	44.07
56.....	76.59	42.34	75.10	43.24	73.58	44.09
58.....	76.55	42.37	75.05	43.27	73.53	44.12
60.....	76.50	42.40	75.00	43.30	73.47	44.15
c= .75	.66	.36	.65	.37	.65	.38
c=1.00	.88	.48	.87	.49	.86	.51
c=1.25	1.10	.60	1.09	.62	1.08	.64

NOTE BY THE EDITOR OF VAN NOSTRAND'S ENGINEERING MAGAZINE.

AFTER the foregoing essay had been published in the Magazine, a criticism of the formula, and of Mr. Winslow's estimate of its applicability, was contributed by R. S. Woodward, C. E., of the Naval Observatory, Washington. The article appeared in the June No. of the Magazine, vol. 30, page 473.

The object of the writer is to show: "1st, that although the formula for conjugate distances, as commonly understood, is inaccurate, yet, if properly interpreted, this formula is not only approximate but exact; and, moreover, applies equally without modification to any combination of lenses as well as to a single biconvex lens; 2d, that the ordinary formula for the stadia instrument, if properly understood, is exact whatever may be the number, kind, or disposition of the lenses in the telescope so long as they are properly centered."

Although the criticism is of importance in its bearing upon the *optical* principles involved, it in no wise affects the value of the reduction tables given above, nor the general principles governing stadia practice as set forth by Mr. Winslow.

ARITHMIC SINES AND TANGENTS.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
0	0	— ∞	— ∞	+ ∞	10	0	90
	1	6,46 37	6,46 37	13,53 63	10,00 00	59	
	2	6,76 48	6,76 48	13,23 52	10,00 00	58	
	3	6,94 08	6,94 08	13,05 91	10,00 00	57	
	4	7,06 58	7,06 58	12,93 42	10,00 00	56	
	5	7,16 27	7,16 27	12,83 73	10,00 00	55	
	6	7,24 19	7,24 19	12,75 81	10,00 00	54	
	7	7,30 83	7,30 88	12,69 12	10,00 00	53	
	8	7,36 68	7,36 68	12,63 32	10,00 00	52	
	9	7,41 80	7,41 80	12,58 20	10,00 00	51	
0	10	7,46 37	7,46 37	12,53 63	10,00 00	50	89
	11	7,50 51	7,50 51	12,49 49	10,00 00	49	
	12	7,54 29	7,54 29	12,45 71	10,00 00	48	
	13	7,57 77	7,57 77	12,42 23	10,00 00	47	
	14	7,60 98	7,60 99	12,39 01	10,00 00	46	
	15	7,63 98	7,63 98	12,36 02	10,00 00	45	
	16	7,66 78	7,66 78	12,33 21	10,00 00	44	
	17	7,69 42	7,69 42	12,30 58	10,00 00	43	
	18	7,71 90	7,71 90	12,28 10	10,00 00	42	
	19	7,74 25	7,74 25	12,25 75	10,00 00	41	
0	20	7,76 47	7,76 48	12,23 52	10,00 00	40	89
	21	7,78 59	7,78 59	12,21 40	10,00 00	39	
	22	7,80 61	7,80 61	12,19 38	10,00 00	38	
	23	7,82 54	7,82 55	12,17 45	10,00 00	37	
	24	7,84 39	7,84 39	12,15 61	10,00 00	36	
	25	7,86 17	7,86 17	12,13 83	10,00 00	35	
	26	7,87 87	7,87 87	12,12 13	10,00 00	34	
	27	7,89 51	7,89 51	12,10 49	10,00 00	33	
	28	7,91 09	7,91 09	12,08 91	10,00 00	32	
	29	7,92 61	7,92 61	12,07 39	10,00 00	31	
0	30	7,94 08	7,94 09	12,05 91	10,00 00	30	89
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	
0	30	7,94 08	7,94 09	12,05 91	10,00 00	1
	31	7,95 51	7,95 51	12,04 49	10,00 00	2
	32	7,96 89	7,96 89	12,03 11	10,00 00	2
	33	7,98 22	7,98 22	12,01 77	10,00 00	2;
	34	7,99 52	7,99 52	12,00 48	10,00 00	26
	35	8,00 78	8,00 78	11,99 22	10,00 00	25
	36	8,02 00	8,02 00	11,98 00	10,00 00	24
	37	8,03 19	8,03 19	11,96 81	10,00 00	23
	38	8,04 35	8,04 35	11,95 65	10,00 00	22
	39	8,05 48	8,05 48	11,94 52	10,00 00	21
0	40	8,06 58	8,06 58	11,93 42	10,00 00	20 8
	41	8,07 65	8,07 65	11,92 35	10,00 00	19
	42	8,08 70	8,08 70	11,91 30	10,00 00	18
	43	8,09 72	8,09 72	11,90 28	10,00 00	17
	44	8,10 72	8,10 72	11,89 28	10,00 00	16
	45	8,11 69	8,11 70	11,88 30	10,00 00	15
	46	8,12 65	8,12 65	11,87 35	10,00 00	14
	47	8,13 58	8,13 58	11,86 41	10,00 00	13
	48	8,14 49	8,14 50	11,85 50	10,00 00	12
	49	8,15 39	8,15 39	11,84 60	10,00 00	11
0	50	8,16 27	8,16 27	11,83 73	9,99 99	10 89
	51	8,17 13	8,17 13	11,82 87	9,99 99	9
	52	8,17 97	8,17 98	11,82 02	9,99 99	8
	53	8,18 80	8,18 80	11,81 20	9,99 99	7
	54	8,19 61	8,19 62	11,80 38	9,99 99	6
	55	8,20 41	8,20 41	11,79 59	9,99 99	5
	56	8,21 19	8,21 19	11,78 80	9,99 99	4
	57	8,21 96	8,21 96	11,78 04	9,99 99	3
	58	8,22 71	8,22 72	11,77 28	9,99 99	2
	59	8,23 46	8,23 46	11,76 54	9,99 99	1
1	0	8,24 19	8,24 19	11,75 81	9,99 99	0
°	′	log cos.	log cotg.	log tang.	log sin.	M.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
1	0	8,24 19	8,24 19	11,75 81	9,99 99	0	89
	1	8,24 90	8,24 91	11,75 09	9,99 99	59	
	2	8,25 61	8,25 62	11,74 38	9,99 99	58	
	3	8,26 30	8,26 31	11,73 69	9,99 99	57	
	4	8,26 99	8,27 00	11,73 00	9,99 99	56	
	5	8,27 66	8,27 67	11,72 33	9,99 99	55	
	6	8,28 32	8,28 33	11,71 67	9,99 99	54	
	7	8,28 98	8,28 99	11,71 01	9,99 99	53	
	8	8,29 62	8,29 63	11,70 37	9,99 99	52	
	9	8,30 25	8,30 26	11,69 74	9,99 99	51	
1	10	8,30 88	8,30 89	11,69 11	9,99 99	50	88
	11	8,31 49	8,31 50	11,68 49	9,99 99	49	
	12	8,32 10	8,32 11	11,67 89	9,99 99	48	
	13	8,32 70	8,32 71	11,67 29	9,99 99	47	
	14	8,33 29	8,33 30	11,66 70	9,99 99	46	
	15	8,33 87	8,33 89	11,66 11	9,99 99	45	
	16	8,34 45	8,34 46	11,65 54	9,99 99	44	
	17	8,35 02	8,35 03	11,64 97	9,99 99	43	
	18	8,35 58	8,35 59	11,64 41	9,99 99	42	
	19	8,36 13	8,36 14	11,63 86	9,99 99	41	
1	20	8,36 68	8,36 69	11,63 31	9,99 99	40	88
	21	8,37 22	8,37 23	11,62 77	9,99 99	39	
	22	8,37 75	8,37 76	11,62 24	9,99 99	38	
	23	8,38 28	8,38 29	11,61 71	9,99 99	37	
	24	8,38 80	8,38 81	11,61 19	9,99 99	36	
	25	8,39 31	8,39 32	11,60 68	9,99 99	35	
	26	8,39 82	8,39 83	11,60 17	9,99 99	34	
	27	8,40 32	8,40 33	11,59 67	9,99 99	33	
	28	8,40 82	8,40 83	11,59 17	9,99 99	32	
	29	8,41 31	8,41 32	11,58 68	9,99 98	31	
1	30	8,41 79	8,41 81	11,58 19	9,99 98	30	88
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
1	30	8,41 79	8,41 81	11,58 19	9,99 98	30	88
	31	8,42 27	8,42 29	11,57 71	9,99 98	29	
	32	8,42 75	8,42 76	11,57 24	9,99 98	28	
	33	8,43 22	8,43 23	11,56 77	9,99 98	27	
	34	8,43 68	8,43 70	11,56 30	9,99 98	26	
	35	8,44 14	8,44 16	11,55 84	9,99 98	25	
	36	8,44 59	8,44 61	11,55 39	9,99 98	24	
	37	8,45 04	8,45 06	11,54 94	9,99 98	23	
	38	8,45 49	8,45 51	11,54 49	9,99 98	22	
	39	8,45 93	8,45 95	11,54 05	9,99 98	21	
1	40	8,46 37	8,46 38	11,53 61	9,99 98	20	8
	41	8,46 80	8,46 82	11,53 18	9,99 98	19	
	42	8,47 23	8,47 24	11,52 75	9,99 98	18	
	43	8,47 65	8,47 67	11,52 33	9,99 98	17	
	44	8,48 07	8,48 09	11,51 91	9,99 98	16	
	45	8,48 48	8,48 50	11,51 49	9,99 98	15	
	46	8,48 90	8,48 92	11,51 08	9,99 98	14	
	47	8,49 30	8,49 32	11,50 67	9,99 98	13	
	48	8,49 71	8,49 73	11,50 27	9,99 98	12	
	49	8,50 11	8,50 13	11,49 87	9,99 98	11	
1	50	8,50 50	8,50 53	11,49 47	9,99 98	10	8
	51	8,50 90	8,50 92	11,49 08	9,99 98	9	
	52	8,51 29	8,51 31	11,48 69	9,99 98	8	
	53	8,51 67	8,51 70	11,48 30	9,99 98	7	
	54	8,52 05	8,52 08	11,47 92	9,99 98	6	
	55	8,52 43	8,52 46	11,47 54	9,99 98	5	
	56	8,52 81	8,52 83	11,47 16	9,99 97	4	
	57	8,53 18	8,53 21	11,46 79	9,99 97	3	
	58	8,53 55	8,53 58	11,46 42	9,99 97	2	
	59	8,53 92	8,53 94	11,46 05	9,99 97	1	
2	0	8,54 28	8,54 31	11,45 69	9,99 97	0	8
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D

M.	log sin.	log tang.	log cotg.	log cos.	′	°
0	8,54 28	8,54 31	11,45 69	9,99 97	**0**	**88**
1	8,54 64	8,54 67	11,45 33	9,99 97	59	
2	8,55 00	8,55 03	11,44 97	9,99 97	58	
3	8,55 35	8,55 38	11,44 62	9,99 97	57	
4	8,55 70	8,55 73	11,44 27	9,99 97	56	
5	8,56 05	8,56 08	11,43 92	9,99 97	55	
6	8,56 40	8,56 43	11,43 57	9,99 97	54	
7	8,56 74	8,56 77	11,43 23	9,99 97	53	
8	8,57 08	8,57 11	11,42 89	9,99 97	52	
9	8,57 42	8,57 45	11,42 55	9,99 97	51	
10	8,57 76	8,57 79	11,42 21	9,99 97	**50**	**87**
11	8,58 09	8,58 12	11,41 88	9,99 97	49	
12	8,58 42	8,58 45	11,41 55	9,99 97	48	
13	8,58 75	8,58 78	11,41 22	9,99 97	47	
14	8,59 07	8,59 10	11,40 89	9,99 97	46	
15	8,59 39	8,59 43	11,40 57	9,99 97	45	
16	8,59 71	8,59 75	11,40 25	9,99 97	44	
17	8,60 03	8,60 07	11,39 93	9,99 97	43	
18	8,60 35	8,60 38	11,39 62	9,99 96	42	
19	8,60 66	8,60 70	11,39 30	9,99 96	41	
20	8,60 97	8,61 01	11,38 99	9,99 96	**40**	**87**
21	8,61 28	8,61 32	11,38 68	9,99 96	39	
22	8,61 59	8,61 63	11,38 37	9,99 96	38	
23	8,61 89	8,61 93	11,38 07	9,99 96	37	
24	8,62 20	8,62 23	11,37 77	9,99 96	36	
25	8,62 50	8,62 53	11,37 46	9,99 96	35	
26	8,62 79	8,62 83	11,37 17	9,99 96	34	
27	8,63 09	8,63 13	11,36 87	9,99 96	33	
28	8,63 38	8,63 43	11,36 57	9,99 96	32	
29	8,63 68	8,63 72	11,36 28	9,99 96	31	
30	8,63 97	8,64 01	11,35 99	9,99 96	**30**	**87**
′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′
2	30	8,63 97	8,64 01	11,35 99	9,99 96	30
	31	8,64 26	8,64 30	11,35 70	9,99 96	29
	32	8,64 54	8,64 58	11,35 41	9,99 96	28
	33	8,64 83	8,64 87	11,35 13	9,99 96	27
	34	8,65 11	8,65 15	11,34 85	9,99 96	26
	35	8,65 39	8,65 43	11,34 56	9,99 96	25
	36	8,65 67	8,65 71	11,34 28	9,99 95	24
	37	8,65 95	8,65 99	11,34 01	9,99 95	23
	38	8,66 22	8,66 27	11,33 73	9,99 95	22
	39	8,66 50	8,66 54	11,33 46	9,99 95	21
2	40	8,66 77	8,66 82	11,33 18	9,99 95	20
	41	8,67 04	8,67 09	11,32 91	9,99 95	19
	42	8,67 31	8,67 36	11,32 64	9,99 95	18
	43	8,67 57	8,67 62	11,32 38	9,99 95	17
	44	8,67 84	8,67 89	11,32 11	9,99 95	16
	45	8,68 10	8,68 15	11,31 85	9,99 95	15
	46	8,68 37	8,68 42	11,31 58	9,99 95	14
	47	8,68 63	8,68 68	11,31 32	9,99 95	13
	48	8,68 89	8,68 94	11,31 06	9,99 95	12
	49	8,69 14	8,69 20	11,30 80	9,99 95	11
2	50	8,69 40	8,69 45	11,30 55	9,99 95	10
	51	8,69 65	8,69 71	11,30 29	9,99 95	9
	52	8,69 91	8,69 96	11,30 04	9,99 95	8
	53	8,70 16	8,70 21	11,29 79	9,99 94	7
	54	8,70 41	8,70 46	11,29 53	9,99 94	6
	55	8,70 66	8,70 71	11,29 29	9,99 94	5
	56	8,70 90	8,70 96	11,29 04	9,99 94	4
	57	8,71 15	8,71 21	11,28 79	9,99 94	3
	58	8,71 39	8,71 45	11,28 55	9,99 94	2
	59	8,71 64	8,71 70	11,28 30	9,99 94	1
3	0	8,71 88	8,71 94	11,28 06	9,99 94	0
°	′	log cos.	log cotg.	log tang.	log sin.	M.

M.	log sin.	log tang.	log cotg.	log cos.	′	°
0	8,71 88	8,71 94	11,28 06	9,99 94	**0**	**87**
1	8,72 12	8,72 18	11,27 82	9,99 94	59	
2	8,72 36	8,72 42	11,27 58	9,99 94	58	
3	8,72 60	8,72 66	11,27 34	9,99 94	57	
4	8,72 83	8,72 90	11,27 10	9,99 94	56	
5	8,73 07	8,73 13	11,26 87	9,99 94	55	
6	8,73 30	8,73 37	11,26 63	9,99 94	54	
7	8,73 53	8,73 60	11,26 40	9,99 94	53	
8	8,73 77	8,73 83	11,26 17	9,99 93	52	
9	8,74 00	8,74 06	11,25 94	9,99 93	51	
10	8,74 23	8,74 29	11,25 71	9,99 93	**50**	**86**
11	8,74 45	8,74 52	11,25 48	9,99 93	49	
12	8,74 68	8,74 75	11,25 25	9,99 93	48	
13	8,74 91	8,74 97	11,25 03	9,99 93	47	
14	8,75 13	8,75 20	11,24 80	9,99 93	46	
15	8,75 35	8,75 42	11,24 58	9,99 93	45	
16	8,75 57	8,75 64	11,24 35	9,99 93	44	
17	8,75 79	8,75 87	11,24 13	9,99 93	43	
18	8,76 01	8,76 09	11,23 91	9,99 93	42	
19	8,76 23	8,76 31	11,23 69	9,99 93	41	
20	8,76 45	8,76 52	11,23 47	9,99 93	**40**	**86**
21	8,76 67	8,76 74	11,23 26	9,99 93	39	
22	8,76 88	8,76 96	11,23 04	9,99 92	38	
23	8,77 10	8,77 17	11,22 83	9,99 92	37	
24	8,77 31	8,77 39	11,22 61	9,99 92	36	
25	8,77 52	8,77 60	11,22 40	9,99 92	35	
26	8,77 73	8,77 81	11,22 19	9,99 92	34	
27	8,77 94	8,78 02	11,21 98	9,99 92	33	
28	8,78 15	8,78 23	11,21 77	9,99 92	32	
29	8,78 36	8,78 44	11,21 56	9,99 92	31	
30	8,78 57	8,78 65	11,21 35	9,99 92	**30**	**86**
′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
3	30	8,78 57	8,78 65	11,21 35	9,99 92	30	86
	31	8,78 77	8,78 85	11,21 14	9,99 92	29	
	32	8,78 98	8,79 06	11,20 94	9,99 92	28	
	33	8,79 18	8,79 27	11,20 73	9,99 92	27	
	34	8,79 39	8,79 47	11,20 53	9,99 92	26	
	35	8,79 59	8,79 67	11,20 33	9,99 91	25	
	36	8,79 79	8,79 87	11,20 12	9,99 91	24	
	37	8,79 99	8,80 08	11,19 92	9,99 91	23	
	38	8,80 19	8,80 28	11,19 72	9,99 91	22	
	39	8,80 39	8,80 48	11,19 52	9,99 91	21	
3	40	8,80 58	8,80 67	11,19 33	9,99 91	20	86
	41	8,80 78	8,80 87	11,19 13	9,99 91	19	
	42	8,80 98	8,81 07	11,18 93	9,99 91	18	
	43	8,81 17	8,81 26	11,18 74	9,99 91	17	
	44	8,81 37	8,81 46	11,18 54	9,99 91	16	
	45	8,81 56	8,81 65	11,18 35	9,99 91	15	
	46	8,81 75	8,81 85	11,18 15	9,99 91	14	
	47	8,81 94	8,82 04	11,17 96	9,99 90	13	
	48	8,82 13	8,82 23	11,17 77	9,99 90	12	
	49	8,82 32	8,82 42	11,17 58	9,99 90	11	
3	50	8,82 51	8,82 61	11,17 39	9,99 90	10	86
	51	8,82 70	8,82 80	11,17 20	9,99 90	9	
	52	8,82 89	8,82 99	11,17 01	9,99 90	8	
	53	8,83 07	8,83 17	11,16 82	9,99 90	7	
	54	8,83 26	8,83 36	11,16 64	9,99 90	6	
	55	8,83 45	8,83 55	11,16 45	9,99 90	5	
	56	8,83 63	8,83 73	11,16 27	9,99 90	4	
	57	8,83 81	8,83 92	11,16 08	9,99 90	3	
	58	8,84 00	8,84 10	11,15 90	9,99 90	2	
	59	8,84 18	8,84 28	11,15 72	9,99 89	1	
4	0	8,84 36	8,84 46	11,15 54	9,99 89	0	86
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

M.	log sin.	log tang.	log cotg.	log cos.	′	°
0	8,84 36	8,84 46	11,15 54	9,99 89	**0**	**86**
1	8,84 54	8,84 65	11,15 35	9,99 89	59	
2	8,84 72	8,84 83	11,15 17	9,99 89	58	
3	8,84 90	8,85 01	11,14 99	9,99 89	57	
4	8,85 07	8,85 18	11,14 81	9,99 89	56	
5	8,85 25	8,85 36	11,14 64	9,99 89	55	
6	8,85 43	8,85 54	11,14 46	9,99 89	54	
7	8,85 60	8,85 72	11,14 28	9,99 89	53	
8	8,85 78	8,85 89	11,14 11	9,99 89	52	
9	8,85 95	8,86 07	11,13 93	9,99 89	51	
10	8,86 13	8,86 24	11,13 76	9,99 88	**50**	**85**
11	8,86 30	8,86 42	11,13 58	9,99 88	49	
12	8,86 47	8,86 59	11,13 41	9,99 88	48	
13	8,86 64	8,86 76	11,13 24	9,99 88	47	
14	8,86 82	8,86 93	11,13 06	9,99 88	46	
15	8,86 99	8,87 11	11,12 89	9,99 88	45	
16	8,87 16	8,87 28	11,12 72	9,99 88	44	
17	8,87 32	8,87 45	11,12 55	9,99 88	43	
18	8,87 49	8,87 62	11,12 38	9,99 88	42	
19	8,87 66	8,87 78	11,12 21	9,99 88	41	
20	8,87 83	8,87 95	11,12 05	9,99 88	**40**	**85**
21	8,87 99	8,88 12	11,11 88	9,99 87	39	
22	8,88 16	8,88 29	11,11 71	9,99 87	38	
23	8,88 33	8,88 45	11,11 55	9,99 87	37	
24	8,88 49	8,88 62	11,11 38	9,99 87	36	
25	8,88 65	8,88 78	11,11 22	9,99 87	35	
26	8,88 82	8,88 95	11,11 05	9,99 87	34	
27	8,88 98	8,89 11	11,10 89	9,99 87	33	
28	8,89 14	8,89 27	11,10 73	9,99 87	32	
29	8,89 30	8,89 44	11,10 56	9,99 87	31	
30	8,89 46	8,89 60	11,10 40	9,99 87	**30**	**85**
′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′
4	30	8,89 46	8,89 60	11,10 40	9,99 87	30
	31	8,89 62	8,89 76	11,10 24	9,99 86	29
	32	8,89 78	8,89 92	11,10 08	9,99 86	28
	33	8,89 94	8,90 08	11,09 92	9,99 86	27
	34	8,90 10	8,90 24	11,09 76	9,99 86	26
	35	8,90 26	8,90 40	11,09 60	9,99 86	25
	36	8,90 42	8,90 56	11,09 44	9,99 86	24
	37	8,90 57	8,90 71	11,09 28	9,99 86	23
	38	8,90 73	8,90 87	11,09 13	9,99 86	22
	39	8,90 88	8,91 03	11,08 97	9,99 86	21
4	40	8,91 04	8,91 18	11,08 81	9,99 86	20
	41	8,91 19	8,91 34	11,08 66	9,99 85	19
	42	8,91 35	8,91 49	11,08 50	9,99 85	18
	43	8,91 50	8,91 65	11,08 35	9,99 85	17
	44	8,91 65	8,91 80	11,08 20	9,99 85	16
	45	8,91 81	8,91 96	11,08 04	9,99 85	15
	46	8,91 96	8,92 11	11,07 89	9,99 85	14
	47	8,92 11	8,92 26	11,07 74	9,99 85	13
	48	8,92 26	8,92 41	11,07 59	9,99 85	12
	49	8,92 41	8,92 56	11,07 43	9,99 85	11
4	50	8,92 56	8,92 72	11,07 28	9,99 84	10
	51	8,92 71	8,92 87	11,07 13	9,99 84	9
	52	8,92 86	8,93 02	11,06 98	9,99 84	8
	53	8,93 01	8,93 16	11,06 83	9,99 84	7
	54	8,93 15	8,93 31	11,06 69	9,99 84	6
	55	8,93 30	8,93 46	11,06 54	9,99 84	5
	56	8,93 45	8,93 61	11,06 39	9,99 84	4
	57	8,93 59	8,93 76	11,06 24	9,99 84	3
	58	8,93 74	8,93 90	11,06 10	9,99 84	2
	59	8,93 88	8,94 05	11,05 95	9,99 84	1
5	0	8,94 03	8,94 19	11,05 80	9,99 83	0
°	′	log cos.	log cotg.	log tang.	log sin.	M.

M.	log sin.	log tang.	log cotg.	log cos.	′	°
0	8,94 03	8,94 19	11,05 80	9,99 83	**0**	**85**
1	8,94 17	8,94 34	11,05 66	9,99 83	59	
2	8,94 32	8,94 48	11,05 51	9,99 83	58	
3	8,94 46	8,94 63	11,05 37	9,99 83	57	
4	8,94 60	8,94 77	11,05 23	9,99 83	56	
5	8,94 75	8,94 92	11,05 08	9,99 83	55	
6	8,94 89	8,95 06	11,04 94	9,99 83	54	
7	8,95 03	8,95 20	11,04 80	9,99 83	53	
8	8,95 17	8,95 34	11,04 66	9,99 82	52	
9	8,95 31	8,95 49	11,04 51	9,99 82	51	
10	8,95 45	8,95 63	11,04 37	9,99 82	**50**	**84**
11	8,95 59	8,95 77	11,04 23	9,99 82	49	
12	8,95 73	8,95 91	11,04 09	9,99 82	48	
13	8,95 87	8,96 05	11,03 95	9,99 82	47	
14	8,96 00	8,96 19	11,03 81	9,99 82	46	
15	8,96 14	8,96 32	11,03 67	9,99 82	45	
16	8,96 28	8,96 46	11,03 54	9,99 82	44	
17	8,96 42	8,96 60	11,03 40	9,99 81	43	
18	8,96 55	8,96 74	11,03 26	9,99 81	42	
19	8,96 69	8,96 88	11,03 12	9,99 81	41	
20	8,96 82	8,97 01	11,02 99	9,99 81	**40**	**84**
21	8,96 96	8,97 15	11,02 85	9,99 81	39	
22	8,97 09	8,97 28	11,02 71	9,99 81	38	
23	8,97 23	8,97 42	11,02 58	9,99 81	37	
24	8,97 36	8,97 56	11,02 44	9,99 81	36	
25	8,97 50	8,97 69	11,02 31	9,99 81	35	
26	8,97 63	8,97 82	11,02 17	9,99 80	34	
27	8,97 76	8,97 96	11,02 04	9,99 80	33	
28	8,97 89	8,98 09	11,01 91	9,99 80	32	
29	8,98 03	8,98 22	11,01 77	9,99 80	31	
30	8,98 16	8,98 36	11,01 64	9,99 80	**30**	**84**
′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log
5	30	8,98 16	8,98 36	11,01 64	9,99
	31	8,98 29	8,98 49	11,01 51	9,99
	32	8,98 42	8,98 62	11,01 38	9,99
	33	8,98 55	8,98 75	11,01 25	9,99
	34	8,98 68	8,98 88	11,01 12	9,99
	35	8,98 81	8,99 01	11,00 98	9,99
	36	8,98 94	8,99 14	11,00 85	9,99
	37	8,99 07	8,99 27	11,00 72	9,99
	38	8,99 19	8,99 40	11,00 59	9,99
	39	8,99 32	8,99 53	11,00 47	9,99
5	40	8,99 45	8,99 66	11,00 34	9,99
	41	8,99 58	8,99 79	11,00 21	9,99
	42	8,99 70	8,99 92	11,00 08	9,99
	43	8,99 83	9,00 05	10,99 95	9,99
	44	8,99 96	9,00 17	10,99 83	9,99
	45	9,00 08	9,00 30	10,99 70	9,99
	46	9,00 21	9,00 43	10,99 57	9,99
	47	9,00 33	9,00 55	10,99 45	9,99
	48	9,00 46	9,00 68	10,99 32	9,99
	49	9,00 58	9,00 80	10,99 19	9,99
5	50	9,00 70	9,00 93	10,99 07	9,99
	51	9,00 83	9,01 05	10,98 94	9,99
	52	9,00 95	9,01 18	10,98 82	9,99
	53	9,01 07	9,01 30	10,98 70	9,99
	54	9,01 20	9,01 43	10,98 57	9,99
	55	9,01 32	9,01 55	10,98 45	9,99
	56	9,01 44	9,01 67	10,98 33	9,99
	57	9,01 56	9,01 80	10,98 20	9,99
	58	9,01 68	9,01 92	10,98 08	9,99
	59	9,01 80	9,02 04	10,97 96	9,99
6	0	9,01 92	9,02 16	10,97 84	9,99
°	′	log cos.	log cotg.	log tang.	log

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
6	**0**	9,01 92	9,02 16	10,97 84	9,99 76	**0**	**84**
	1	9,02 04	9,02 28	10,97 72	9,99 76	59	
	2	9,02 16	9,02 40	10,97 60	9,99 76	58	
	3	9,02 28	9,02 52	10,97 47	9,99 76	57	
	4	9,02 40	9,02 64	10,97 35	9,99 76	56	
	5	9,02 52	9,02 77	10,97 23	9,99 75	55	
	6	9,02 64	9,02 88	10,97 11	9,99 75	54	
	7	9,02 76	9,03 00	10,96 99	9,99 75	53	
	8	9,02 87	9,03 12	10,96 88	9,99 75	52	
	9	9,02 99	9,03 24	10,96 76	9,99 75	51	
6	**10**	9,03 11	9,03 36	10,96 64	9,99 75	**50**	**83**
	11	9,03 23	9,03 48	10,96 52	9,99 75	49	
	12	9,03 34	9,03 60	10,96 40	9,99 74	48	
	13	9,03 46	9,03 71	10,96 29	9,99 74	47	
	14	9,03 57	9,03 83	10,96 17	9,99 74	46	
	15	9,03 69	9,03 95	10,96 05	9,99 74	45	
	16	9,03 80	9,04 06	10,95 93	9,99 74	44	
	17	9,03 92	9,04 18	10,95 82	9,99 74	43	
	18	9,04 03	9,04 30	10,95 70	9,99 74	42	
	19	9,04 15	9,04 41	10,95 59	9,99 74	41	
6	**20**	9,04 26	9,04 53	10,95 47	9,99 73	**40**	**83**
	21	9,04 38	9,04 64	10,95 36	9,99 73	39	
	22	9,04 49	9,04 76	10,95 24	9,99 73	38	
	23	9,04 60	9,04 87	10,95 13	9,99 73	37	
	24	9,04 71	9,04 99	10,95 01	9,99 73	36	
	25	9,04 83	9,05 10	10,94 90	9,99 73	35	
	26	9,04 94	9,05 21	10,94 79	9,99 73	34	
	27	9,05 05	9,05 33	10,94 67	9,99 72	33	
	28	9,05 16	9,05 44	10,94 56	9,99 72	32	
	29	9,05 27	9,05 55	10,94 45	9,99 72	31	
6	**30**	9,05 39	9,05 67	10,94 33	9,99 72	**30**	**83**
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
6	30	9,05 39	9,05 67	10,94 33	9,99 72	30	83
	31	9,05 50	9,05 78	10,94 22	9,99 72	29	
	32	9,05 61	9,05 89	10,94 11	9,99 72	28	
	33	9,05 72	9,06 00	10,94 00	9,99 72	27	
	34	9,05 83	9,06 11	10,93 89	9,99 71	26	
	35	9,05 94	9,06 22	10,93 78	9,99 71	25	
	36	9,06 05	9,06 33	10,93 66	9,99 71	24	
	37	9,06 15	9,06 44	10,93 55	9,99 71	23	
	38	9,06 26	9,06 56	10,93 44	9,99 71	22	
	39	9,06 37	9,06 67	10,93 33	9,99 71	21	
6	40	9,06 48	9,06 77	10,93 22	9,99 70	20	83
	41	9,06 59	9,06 88	10,93 11	9,99 70	19	
	42	9,06 70	9,06 99	10,93 01	9,99 70	18	
	43	9,06 80	9,07 10	10,92 90	9,99 70	17	
	44	9,06 91	9,07 21	10,92 79	9,99 70	16	
	45	9,07 02	9,07 32	10,92 68	9,99 70	15	
	46	9,07 12	9,07 43	10,92 57	9,99 70	14	
	47	9,07 23	9,07 54	10,92 46	9,99 69	13	
	48	9,07 34	9,07 64	10,92 36	9,99 69	12	
	49	9,07 44	9,07 75	10,92 25	9,99 69	11	
6	50	9,07 55	9,07 86	10,92 14	9,99 69	10	83
	51	9,07 65	9,07 96	10,92 04	9,99 69	9	
	52	9,07 76	9,08 07	10,91 93	9,99 69	8	
	53	9,07 86	9,08 18	10,91 82	9,99 69	7	
	54	9,07 97	9,08 28	10,91 72	9,99 68	6	
	55	9,08 07	9,08 39	10,91 61	9,99 68	5	
	56	9,08 18	9,08 49	10,91 50	9,99 68	4	
	57	9,08 28	9,08 60	10,91 40	9,99 68	3	
	58	9,08 38	9,08 70	10,91 29	9,99 68	2	
	59	9,08 49	9,08 81	10,91 19	9,99 68	1	
7	0	9,08 59	9,08 91	10,91 09	9,99 67	0	83
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
7	**0**	9,08 59	9,08 91	10,91 09	9,99 67	**0**	**83**
	1	9,08 69	9,09 02	10,90 98	9,99 67	59	
	2	9,08 79	9,09 12	10,90 88	9,99 67	58	
	3	9,08 90	9,09 23	10,90 77	9,99 67	57	
	4	9,09 00	9,09 33	10,90 67	9,99 67	56	
	5	9,09 10	9,09 43	10,90 57	9,99 67	55	
	6	9,09 20	9,09 54	10,90 46	9,99 67	54	
	7	9,09 30	9,09 64	10,90 36	9,99 66	53	
	8	9,09 40	9,09 74	10,90 26	9,99 66	52	
	9	9,09 51	9,09 84	10,90 15	9,99 66	51	
7	**10**	9,09 61	9,09 95	10,90 05	9,99 66	**50**	**82**
	11	9,09 71	9,10 05	10,89 95	9,99 66	49	
	12	9,09 81	9,10 15	10,89 85	9,99 66	48	
	13	9,09 91	9,10 25	10,89 75	9,99 65	47	
	14	9,10 01	9,10 35	10,89 65	9,99 65	46	
	15	9,10 11	9,10 45	10,89 55	9,99 65	45	
	16	9,10 20	9,10 55	10,89 44	9,99 65	44	
	17	9,10 30	9,10 66	10,89 34	9,99 65	43	
	18	9,10 40	9,10 76	10,89 24	9,99 65	42	
	19	9,10 50	9,10 86	10,89 14	9,99 64	41	
7	**20**	9,10 60	9,10 96	10,89 04	9,99 64	**40**	**82**
	21	9,10 70	9,11 06	10,88 94	9,99 64	39	
	22	9,10 79	9,11 15	10,88 84	9,99 64	38	
	23	9,10 89	9,11 25	10,88 75	9,99 64	37	
	24	9,10 99	9,11 35	10,88 65	9,99 64	36	
	25	9,11 09	9,11 45	10,88 55	9,99 63	35	
	26	9,11 18	9,11 55	10,88 45	9,99 63	34	
	27	9,11 28	9,11 65	10,88 35	9,99 63	33	
	28	9,11 38	9,11 75	10,88 25	9,99 63	32	
	29	9,11 47	9,11 84	10,88 15	9,99 63	31	
7	**30**	9,11 57	9,11 94	10,88 06	9,99 63	**30**	**82**
°	′	*log cos.*	*log cotg.*	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
7	30	9,11 57	9,11 94	10,88 06	9,99 63	30	82
	31	9,11 67	9,12 04	10,87 96	9,99 62	29	
	32	9,11 76	9,12 14	10,87 86	9,99 62	28	
	33	9,11 86	9,12 23	10,87 76	9,99 62	27	
	34	9,11 95	9,12 33	10,87 67	9,99 62	26	
	35	9,12 05	9,12 43	10,87 57	9,99 62	25	
	36	9,12 14	9,12 52	10,87 47	9,99 62	24	
	37	9,12 24	9,12 62	10,87 38	9,99 61	23	
	38	9,12 33	9,12 72	10,87 28	9,99 61	22	
	39	9,12 42	9,12 81	10,87 19	9,99 61	21	
7	40	9,12 52	9,12 91	10,87 09	9,99 61	20	82
	41	9,12 61	9,13 00	10,87 00	9,99 61	19	
	42	9,12 71	9,13 10	10,86 90	9,99 61	18	
	43	9,12 80	9,13 19	10,86 81	9,99 60	17	
	44	9,12 89	9,13 29	10,86 71	9,99 60	16	
	45	9,12 98	9,13 38	10,86 62	9,99 60	15	
	46	9,13 08	9,13 48	10,86 52	9,99 60	14	
	47	9,13 17	9,13 57	10,86 43	9,99 60	13	
	48	9,13 26	9,13 67	10,86 33	9,99 60	12	
	49	9,13 35	9,13 76	10,86 24	9,99 59	11	
7	50	9,13 45	9,13 85	10,86 15	9,99 59	10	82
	51	9,13 54	9,13 95	10,86 05	9,99 59	9	
	52	9,13 63	9,14 04	10,85 96	9,99 59	8	
	53	9,13 72	9,14 13	10,85 87	9,99 59	7	
	54	9,13 81	9,14 23	10,85 77	9,99 59	6	
	55	9,13 90	9,14 32	10,85 68	9,99 58	5	
	56	9,13 99	9,14 41	10,85 59	9,99 58	4	
	57	9,14 08	9,14 50	10,85 50	9,99 58	3	
	58	9,14 17	9,14 60	10,85 40	9,99 58	2	
	59	9,14 27	9,14 69	10,85 31	9,99 58	1	
8	0	9,14 36	9,14 78	10,85 22	9,99 57	0	82
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

M.	log sin.	log tang.	log cotg.	log cos.	′	°
0	9,14 36	9,14 78	10,85 22	9,99 57	**0**	**82**
1	9,14 44	9,14 87	10,85 13	9,99 57	59	
2	9,14 53	9,14 96	10,85 04	9,99 57	58	
3	9,14 62	9,15 05	10,84 95	9,99 57	57	
4	9,14 71	9,15 14	10,84 85	9,99 57	56	
5	9,14 80	9,15 24	10,84 76	9,99 57	55	
6	9,14 89	9,15 33	10,84 67	9,99 56	54	
7	9,14 98	9,15 42	10,84 58	9,99 56	53	
8	9,15 07	9,15 51	10,84 49	9,99 56	52	
9	9,15 16	9,15 60	10,84 40	9,99 56	51	
10	9,15 24	9,15 69	10,84 31	9,99 56	**50**	**81**
11	9,15 33	9,15 78	10,84 22	9,99 56	49	
12	9,15 42	9,15 87	10,84 13	9,99 55	48	
13	9,15 51	9,15 96	10,84 04	9,99 55	47	
14	9,15 60	9,16 05	10,83 95	9,99 55	46	
15	9,15 68	9,16 13	10,83 86	9,99 55	45	
16	9,15 77	9,16 22	10,83 78	9,99 55	44	
17	9,15 86	9,16 31	10,83 69	9,99 54	43	
18	9,15 94	9,16 40	10,83 60	9,99 54	42	
19	9,16 03	9,16 49	10,83 51	9,99 54	41	
20	9,16 12	9,16 58	10,83 42	9,99 54	**40**	**81**
21	9,16 20	9,16 66	10,83 33	9,99 54	39	
22	9,16 29	9,16 75	10,83 25	9,99 53	38	
23	9,16 37	9,16 84	10,83 16	9,99 53	37	
24	9,16 46	9,16 93	10,83 07	9,99 53	36	
25	9,16 54	9,17 02	10,82 98	9,99 53	35	
26	9,16 63	9,17 10	10,82 90	9,99 53	34	
27	9,16 72	9,17 19	10,82 81	9,99 53	33	
28	9,16 80	9,17 28	10,82 72	9,99 52	32	
29	9,16 89	9,17 36	10,82 64	9,99 52	31	
30	9,16 97	9,17 45	10,82 55	9,99 52	**30**	**81**
′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.

8

8

8

M.	log sin.	log tang.	log cotg.	log cos.	′	°
0	9,19 43	9,19 97	10,80 03	9,99 46	**0**	**81**
1	9,19 51	9,20 05	10,79 95	9,99 46	59	
2	9,19 59	9,20 13	10,79 87	9,99 46	58	
3	9,19 67	9,20 22	10,79 78	9,99 46	57	
4	9,19 75	9,20 30	10,79 70	9,99 45	56	
5	9,19 83	9,20 38	10,79 62	9,99 45	55	
6	9,19 91	9,20 46	10,79 54	9,99 45	54	
7	9,19 99	9,20 54	10,79 46	9,99 45	53	
8	9,20 07	9,20 62	10,79 38	9,99 45	52	
9	9,20 14	9,20 70	10,79 30	9,99 44	51	
10	9,20 22	9,20 78	10,79 22	9,99 44	**50**	**80**
11	9,20 30	9,20 86	10,79 14	9,99 44	49	
12	9,20 38	9,20 94	10,79 06	9,99 44	48	
13	9,20 46	9,21 02	10,78 98	9,99 44	47	
14	9,20 53	9,21 10	10,78 90	9,99 43	46	
15	9,20 61	9,21 18	10,78 82	9,99 43	45	
16	9,20 69	9,21 26	10,78 74	9,99 43	44	
17	9,20 77	9,21 34	10,78 66	9,99 43	43	
18	9,20 84	9,21 42	10,78 58	9,99 42	42	
19	9,20 92	9,21 50	10,78 50	9,99 42	41	
20	9,21 00	9,21 58	10,78 42	9,99 42	**40**	**80**
21	9,21 08	9,21 66	10,78 34	9,99 42	39	
22	9,21 15	9,21 74	10,78 26	9,99 42	38	
23	9,21 23	9,21 81	10,78 19	9,99 41	37	
24	9,21 31	9,21 89	10,78 11	9,99 41	36	
25	9,21 38	9,21 97	10,78 03	9,99 41	35	
26	9,21 46	9,22 05	10,77 95	9,99 41	34	
27	9,21 53	9,22 13	10,77 87	9,99 41	33	
28	9,21 61	9,22 20	10,77 79	9,99 40	32	
29	9,21 68	9,22 28	10,77 72	9,99 40	31	
30	9,21 76	9,22 36	10,77 64	9,99 40	**30**	**80**
′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	
9	30	9,21 76	9,22 36	10,77 64	9,99 40	
	31	9,21 84	9,22 44	10,77 56	9,99 40	
	32	9,21 91	9,22 52	10,77 48	9,99 40	
	33	9,21 99	9,22 59	10,77 41	9,99 39	
	34	9,22 06	9,22 67	10,77 33	9,99 39	
	35	9,22 14	9,22 75	10,77 25	9,99 39	
	36	9,22 21	9,22 82	10,77 18	9,99 39	
	37	9,22 29	9,22 90	10,77 10	9,99 38	
	38	9,22 36	9,22 98	10,77 02	9,99 38	
	39	9,22 43	9,23 05	10,76 95	9,99 38	
9	40	9,22 51	9,23 13	10,76 87	9,99 38	20
	41	9,22 58	9,23 21	10,76 79	9,99 38	19
	42	9,22 66	9,23 28	10,76 72	9,99 37	18
	43	9,22 73	9,23 36	10,76 64	9,99 37	17
	44	9,22 80	9,23 43	10,76 56	9,99 37	16
	45	9,22 88	9,23 51	10,76 49	9,99 37	15
	46	9,22 95	9,23 59	10,76 41	9,99 37	14
	47	9,23 02	9,23 66	10,76 34	9,99 36	13
	48	9,23 10	9,23 74	10,76 26	9,99 36	12
	49	9,23 17	9,23 81	10,76 19	9,99 36	11
9	50	9,23 24	9,23 89	10,76 11	9,99 36	10 80
	51	9,23 32	9,23 96	10,76 04	9,99 35	9
	52	9,23 39	9,24 04	10,75 96	9,99 35	8
	53	9,23 46	9,24 11	10,75 89	9,99 35	7
	54	9,23 53	9,24 19	10,75 81	9,99 35	6
	55	9,23 61	9,24 26	10,75 74	9,99 35	5
	56	9,23 68	9,24 33	10,75 66	9,99 34	4
	57	9,23 75	9,24 41	10,75 59	9,99 34	3
	58	9,23 82	9,24 48	10,75 52	9,99 34	2
	59	9,23 89	9,24 56	10,75 44	9,99 34	1
10	0	9,23 97	9,24 63	10,75 37	9,99 33	0 80
°	′	log cos.	log cotg.	log tang.	log sin.	M. D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
10	0	9,23 97	9,24 63	10,75 37	9,99 33	0	80
	1	9,24 04	9,24 71	10,75 29	9,99 33	59	
	2	9,24 11	9,24 78	10,75 22	9,99 33	58	
	3	9,24 18	9,24 85	10,75 15	9,99 33	57	
	4	9,24 25	9,24 93	10,75 07	9,99 33	56	
	5	9,24 32	9,25 00	10,75 00	9,99 32	55	
	6	9,24 39	9,25 07	10,74 93	9,99 32	54	
	7	9,24 47	9,25 15	10,74 85	9,99 32	53	
	8	9,24 54	9,25 22	10,74 78	9,99 32	52	
	9	9,24 61	9,25 29	10,74 71	9,99 31	51	
10	10	9,24 68	9,25 36	10,74 63	9,99 31	50	79
	11	9,24 75	9,25 44	10,74 56	9,99 31	49	
	12	9,24 82	9,25 51	10,74 49	9,99 31	48	
	13	9,24 89	9,25 58	10,74 42	9,99 31	47	
	14	9,24 96	9,25 65	10,74 34	9,99 30	46	
	15	9,25 03	9,25 73	10,74 27	9,99 30	45	
	16	9,25 10	9,25 80	10,74 20	9,99 30	44	
	17	9,25 17	9,25 87	10,74 13	9,99 30	43	
	18	9,25 24	9,25 94	10,74 06	9,99 29	42	
	19	9,25 31	9,26 01	10,73 98	9,99 29	41	
10	20	9,25 38	9,26 09	10,73 91	9,99 29	40	79
	21	9,25 44	9,26 16	10,73 84	9,99 29	39	
	22	9,25 51	9,26 23	10,73 77	9,99 28	38	
	23	9,25 58	9,26 30	10,73 70	9,99 28	37	
	24	9,25 65	9,26 37	10,73 63	9,99 28	36	
	25	9,25 72	9,26 44	10,73 56	9,99 28	35	
	26	9,25 79	9,26 51	10,73 49	9,99 28	34	
	27	9,25 86	9,26 58	10,73 41	9,99 27	33	
	28	9,25 93	9,26 65	10,73 34	9,99 27	32	
	29	9,25 99	9,26 73	10,73 27	9,99 27	31	
10	30	9,26 06	9,26 80	10,73 20	9,99 27	30	79
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
10	30	9,26 06	9,26 80	10,73 20	9,99 27	30	79
	31	9,26 13	9,26 87	10,73 13	9,99 26	29	
	32	9,26 20	9,26 94	10,73 06	9,99 26	28	
	33	9,26 27	9,27 01	10,72 99	9,99 26	27	
	34	9,26 33	9,27 08	10,72 92	9,99 26	26	
	35	9,26 40	9,27 15	10,72 85	9,99 25	25	
	36	9,26 47	9,27 22	10,72 78	9,99 25	24	
	37	9,26 54	9,27 29	10,72 71	9,99 25	23	
	38	9,26 60	9,27 36	10,72 64	9,99 25	22	
	39	9,26 67	9,27 43	10,72 57	9,99 24	21	
10	40	9,26 74	9,27 50	10,72 50	9,99 24	20	79
	41	9,26 81	9,27 57	10,72 43	9,99 24	19	
	42	9,26 87	9,27 63	10,72 36	9,99 24	18	
	43	9,26 94	9,27 70	10,72 30	9,99 24	17	
	44	9,27 01	9,27 77	10,72 23	9,99 23	16	
	45	9,27 07	9,27 84	10,72 16	9,99 23	15	
	46	9,27 14	9,27 91	10,72 09	9,99 23	14	
	47	9,27 21	9,27 98	10,72 02	9,99 23	13	
	48	9,27 27	9,28 05	10,71 95	9,99 22	12	
	49	9,27 34	9,28 12	10,71 88	9,99 22	11	
10	50	9,27 40	9,28 19	10,71 81	9,99 22	10	79
	51	9,27 47	9,28 25	10,71 75	9,99 22	9	
	52	9,27 54	9,28 32	10,71 68	9,99 21	8	
	53	9,27 60	9,28 39	10,71 61	9,99 21	7	
	54	9,27 67	9,28 46	10,71 54	9,99 21	6	
	55	9,27 73	9,28 53	10,71 47	9,99 21	5	
	56	9,27 80	9,28 59	10,71 40	9,99 20	4	
	57	9,27 86	9,28 66	10,71 34	9,99 20	3	
	58	9,27 93	9,28 73	10,71 27	9,99 20	2	
	59	9,27 99	9,28 80	10,71 20	9,99 20	1	
11	0	9,28 06	9,28 86	10,71 13	9,99 19	0	79
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
11	**0**	9,28 06	9,28 86	10,71 13	9,99 19	**0**	**79**
	1	9,28 12	9,28 93	10,71 07	9,99 19	59	
	2	9,28 19	9,29 00	10,71 00	9,99 19	58	
	3	9,28 25	9,29 07	10,70 93	9,99 19	57	
	4	9,28 32	9,29 13	10,70 87	9,99 18	56	
	5	9,28 38	9,29 20	10,70 80	9,99 18	55	
	6	9,28 45	9,29 27	10,70 73	9,99 18	54	
	7	9,28 51	9,29 33	10,70 66	9,99 18	53	
	8	9,28 58	9,29 40	10,70 60	9,99 17	52	
	9	9,28 64	9,29 47	10,70 53	9,99 17	51	
11	**10**	9,28 70	9,29 53	10,70 46	9,99 17	**50**	**78**
	11	9,28 77	9,29 60	10,70 40	9,99 17	49	
	12	9,28 83	9,29 67	10,70 33	9,99 16	48	
	13	9,28 90	9,29 73	10,70 27	9,99 16	47	
	14	9,28 96	9,29 80	10,70 20	9,99 16	46	
	15	9,29 02	9,29 87	10,70 13	9,99 16	45	
	16	9,29 09	9,29 93	10,70 07	9,99 15	44	
	17	9,29 15	9,30 00	10,70 00	9,99 15	43	
	18	9,29 21	9,30 06	10,69 94	9,99 15	42	
	19	9,29 28	9,30 13	10,69 87	9,99 15	41	
11	**20**	9,29 34	9,30 19	10,69 80	9,99 14	**40**	**78**
	21	9,29 40	9,30 26	10,69 74	9,99 14	39	
	22	9,29 47	9,30 33	10,69 67	9,99 14	38	
	23	9,29 53	9,30 39	10,69 61	9,99 14	37	
	24	9,29 59	9,30 46	10,69 54	9,99 13	36	
	25	9,29 65	9,30 52	10,69 48	9,99 13	35	
	26	9,29 72	9,30 59	10,69 41	9,99 13	34	
	27	9,29 78	9,30 65	10,69 35	9,99 13	33	
	28	9,29 84	9,30 72	10,69 28	9,99 12	32	
	29	9,29 90	9,30 78	10,69 22	9,99 12	31	
11	**30**	9,29 97	9,30 85	10,69 15	9,99 12	**30**	**78**
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
11	30	9,29 97	9,30 85	10,69 15	9,99 12	30	78
	31	9,30 03	9,30 91	10,69 09	9,99 12	29	
	32	9,30 09	9,30 97	10,69 02	9,99 11	28	
	33	9,30 15	9,31 04	10,68 96	9,99 11	27	
	34	9,30 21	9,31 10	10,68 90	9,99 11	26	
	35	9,30 27	9,31 17	10,68 83	9,99 11	25	
	36	9,30 34	9,31 23	10,68 77	9,99 10	24	
	37	9,30 40	9,31 30	10,68 70	9,99 10	23	
	38	9,30 46	9,31 36	10,68 64	9,99 10	22	
	39	9,30 52	9,31 42	10,68 57	9,99 10	21	
11	40	9,30 58	9,31 49	10,68 51	9,99 09	20	78
	41	9,30 64	9,31 55	10,68 45	9,99 09	19	
	42	9,30 70	9,31 62	10,68 38	9,99 09	18	
	43	9,30 76	9,31 68	10,68 32	9,99 09	17	
	44	9,30 83	9,31 74	10,68 26	9,99 08	16	
	45	9,30 89	9,31 81	10,68 19	9,99 08	15	
	46	9,30 95	9,31 87	10,68 13	9,99 08	14	
	47	9,31 01	9,31 93	10,68 07	9,99 07	13	
	48	9,31 07	9,32 00	10,68 00	9,99 07	12	
	49	9,31 13	9,32 06	10,67 94	9,99 07	11	
11	50	9,31 19	9,32 12	10,67 88	9,99 07	10	78
	51	9,31 25	9,32 18	10,67 81	9,99 06	9	
	52	9,31 31	9,32 25	10,67 75	9,99 06	8	
	53	9,31 37	9,32 31	10,67 69	9,99 06	7	
	54	9,31 43	9,32 37	10,67 63	9,99 06	6	
	55	9,31 49	9,32 44	10,67 56	9,99 05	5	
	56	9,31 55	9,32 50	10,67 50	9,99 05	4	
	57	9,31 61	9,32 56	10,67 44	9,99 05	3	
	58	9,31 67	9,32 62	10,67 38	9,99 05	2	
	59	9,31 73	9,32 68	10,67 31	9,99 04	1	
12	0	9,31 79	9,32 75	10,67 25	9,99 04	0	78
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
12	0	9,31 79	9,32 75	10,67 25	9,99 04	0	78
	1	9,31 85	9,32 81	10,67 19	9,99 04	59	
	2	9,31 91	9,32 87	10,67 13	9,99 03	58	
	3	9,31 97	9,32 93	10,67 07	9,99 03	57	
	4	9,32 02	9,32 99	10,67 00	9,99 03	56	
	5	9,32 08	9,33 06	10,66 94	9,99 03	55	
	6	9,32 14	9,33 12	10,66 88	9,99 02	54	
	7	9,32 20	9,33 18	10,66 82	9,99 02	53	
	8	9,32 26	9,33 24	10,66 76	9,99 02	52	
	9	9,32 32	9,33 30	10,66 70	9,99 02	51	
12	10	9,32 38	9,33 36	10,66 63	9,99 01	50	77
	11	9,32 44	9,33 43	10,66 57	9,99 01	49	
	12	9,32 49	9,33 49	10,66 51	9,99 01	48	
	13	9,32 55	9,33 55	10,66 45	9,99 00	47	
	14	9,32 61	9,33 61	10,66 39	9,99 00	46	
	15	9,32 67	9,33 67	10,66 33	9,99 00	45	
	16	9,32 73	9,33 73	10,66 27	9,99 00	44	
	17	9,32 79	9,33 79	10,66 21	9,98 99	43	
	18	9,32 84	9,33 85	10,66 15	9,98 99	42	
	19	9,32 90	9,33 91	10,66 09	9,98 99	41	
12	20	9,32 96	9,33 97	10,66 03	9,98 99	40	77
	21	9,33 02	9,34 03	10,65 97	9,98 98	39	
	22	9,33 07	9,34 09	10,65 90	9,98 98	38	
	23	9,33 13	9,34 15	10,65 84	9,98 98	37	
	24	9,33 19	9,34 21	10,65 78	9,98 97	36	
	25	9,33 25	9,34 28	10,65 72	9,98 97	35	
	26	9,33 30	9,34 34	10,65 66	9,98 97	34	
	27	9,33 36	9,34 40	10,65 60	9,98 97	33	
	28	9,33 42	9,34 46	10,65 54	9,98 96	32	
	29	9,33 48	9,34 52	10,65 48	9,98 96	31	
12	30	9,33 53	9,34 58	10,65 42	9,98 96	30	77
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

°	M	log sin.	log tang.	log cotg.	log cos.		
12	30	9,33 53	9,34 53	10,65 47	9,98		30
	31	9,33 59	9,34 63	10,65 37	9,98		29
	32	9,33 65	9,34 69	10,65 31	9,98		28
	33	9,33 70	9,34 75	10,65 25	9,98		27
	34	9,33 76	9,34 81	10,65 19	9,98		26
	35	9,33 82	9,34 87	10,65 13	9,98		25
	36	9,33 87	9,34 93	10,65 07	9,98		24
	37	9,33 93	9,34 99	10,65 01	9,98		23
	38	9,33 99	9,35 05	10,64 95	9,98		22
	39	9,34 04	9,35 11	10,64 89	9,98		21
13	40	9,34 10	9,35 17	10,64 83	9,98	93	20
	41	9,34 16	9,35 23	10,64 77	9,98	93	19
	42	9,34 21	9,35 29	10,64 71	9,98	92	18
	43	9,34 27	9,35 35	10,64 65	9,98	92	17
	44	9,34 32	9,35 40	10,64 59	9,98	92	16
	45	9,34 38	9,35 46	10,64 54	9,98	92	15
	46	9,34 44	9,35 52	10,64 48	9,98	91	14
	47	9,34 49	9,35 58	10,64 42	9,98	91	13
	48	9,34 55	9,35 64	10,64 36	9,98	91	12
	49	9,34 60	9,35 70	10,64 30	9,98	90	11
14	50	9,34 66	9,35 76	10,64 24	9,98	90	10
	51	9,34 71	9,35 81	10,64 18	9,98	90	9
	52	9,34 77	9,35 87	10,64 13	9,98	90	8
	53	9,34 82	9,35 93	10,64 07	9,98	89	7
	54	9,34 88	9,35 99	10,64 01	9,98	89	6
	55	9,34 94	9,36 05	10,63 95	9,98	89	5
	56	9,34 99	9,36 10	10,63 89	9,98	88	4
	57	9,35 05	9,36 16	10,63 84	9,98	88	3
	58	9,35 10	9,36 22	10,63 78	9,98	88	2
	59	9,35 16	9,36 28	10,63 72	9,98	87	1
15	0	9,35 21	9,36 34	10,63 66	9,98	87	0
°	M	log cos.	log cotg.	log tang.	log sin.		M.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
13	0	9,35 21	9,36 34	10,63 66	9,98 87	0	77
	1	9,35 26	9,36 39	10,63 61	9,98 87	59	
	2	9,35 32	9,36 45	10,63 55	9,98 87	58	
	3	9,35 37	9,36 51	10,63 49	9,98 86	57	
	4	9,35 43	9,36 57	10,63 43	9,98 86	56	
	5	9,35 48	9,36 62	10,63 38	9,98 86	55	
	6	9,35 54	9,36 68	10,63 32	9,98 85	54	
	7	9,35 59	9,36 74	10,63 26	9,98 85	53	
	8	9,35 64	9,36 79	10,63 20	9,98 85	52	
	9	9,35 70	9,36 85	10,63 15	9,98 85	51	
13	10	9,35 75	9,36 91	10,63 09	9,98 84	50	76
	11	9,35 81	9,36 97	10,63 03	9,98 84	49	
	12	9,35 86	9,37 02	10,62 98	9,98 84	48	
	13	9,35 91	9,37 08	10,62 92	9,98 83	47	
	14	9,35 97	9,37 14	10,62 86	9,98 83	46	
	15	9,36 02	9,37 19	10,62 81	9,98 83	45	
	16	9,36 07	9,37 25	10,62 75	9,98 82	44	
	17	9,36 13	9,37 31	10,62 69	9,98 82	43	
	18	9,36 18	9,37 36	10,62 64	9,98 82	42	
	19	9,36 24	9,37 42	10,62 58	9,98 82	41	
13	20	9,36 29	9,37 48	10,62 52	9,98 81	40	76
	21	9,36 34	9,37 53	10,62 47	9,98 81	39	
	22	9,36 39	9,37 59	10,62 41	9,98 81	38	
	23	9,36 45	9,37 64	10,62 36	9,98 80	37	
	24	9,36 50	9,37 70	10,62 30	9,98 80	36	
	25	9,36 55	9,37 76	10,62 24	9,98 80	35	
	26	9,36 61	9,37 81	10,62 19	9,98 79	34	
	27	9,36 66	9,37 87	10,62 13	9,98 79	33	
	28	9,36 71	9,37 92	10,62 08	9,98 79	32	
	29	9,36 77	9,37 98	10,62 02	9,98 79	31	
13	30	9,36 82	9,38 03	10,61 96	9,98 78	30	76
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
13	30	9,36 82	9,38 03	10,61 96	9,98 78	30	76
	31	9,36 87	9,38 09	10,61 91	9,98 78	29	
	32	9,36 92	9,38 15	10,61 85	9,98 78	28	
	33	9,36 98	9,38 20	10,61 80	9,98 77	27	
	34	9,37 03	9,38 26	10,61 74	9,98 77	26	
	35	9,37 08	9,38 31	10,61 69	9,98 77	25	
	36	9,37 13	9,38 37	10,61 63	9,98 76	24	
	37	9,37 18	9,38 42	10,61 58	9,98 76	23	
	38	9,37 24	9,38 48	10,61 52	9,98 76	22	
	39	9,37 29	9,38 53	10,61 47	9,98 76	21	
13	40	9,37 34	9,38 59	10,61 41	9,98 75	20	76
	41	9,37 39	9,38 64	10 61 36	9,98 75	19	
	42	9,37 44	9,38 70	10,61 30	9,98 75	18	
	43	9,37 50	9,38 75	10,61 25	9,98 74	17	
	44	9,37 55	9,38 81	10,61 19	9,98 74	16	
	45	9,37 60	9,38 86	10,61 14	9,98 74	15	
	46	9,37 65	9,38 92	10,61 08	9,98 73	14	
	47	9,37 70	9,38 97	10,61 03	9,98 73	13	
	48	9,37 75	9,39 03	10,60 97	9,98 73	12	
	49	9,37 81	9,39 08	10,60 92	9,98 72	11	
13	50	9,37 86	9,39 14	10,60 86	9,98 72	10	76
	51	9,37 91	9,39 19	10,60 81	9,98 72	9	
	52	9,37 96	9,39 24	10,60 75	9,98 71	8	
	53	9,38 01	9,39 30	10,60 70	9,98 71	7	
	54	9,38 06	9,39 35	10,60 65	9,98 71	6	
	55	9,38 11	9,39 41	10,60 59	9,98 71	5	
	56	9,38 16	9,39 46	10,60 54	9,98 70	4	
	57	9,38 21	9,39 51	10,60 48	9,98 70	3	
	58	9,38 27	9,39 57	10,60 43	9,98 70	2	
	59	9,38 32	9,39 62	10,60 38	9,98 69	1	
14	0	9,38 37	9,39 68	10,60 32	9,98 69	0	76
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
4	**0**	9,38 37	9,39 68	10,60 32	9,98 69	**0**	**76**
	1	9,38 42	9,39 73	10,60 27	9,98 69	59	
	2	9,38 47	9,39 78	10,60 21	9,98 68	58	
	3	9,38 52	9,39 84	10,60 16	9,98 68	57	
	4	9,38 57	9,39 89	10,60 11	9,98 68	56	
	5	9,38 62	9,39 94	10,60 05	9,98 67	55	
	6	9,38 67	9,40 00	10,60 00	9,98 67	54	
	7	9,38 72	9,40 05	10,59 95	9,98 67	53	
	8	9,38 77	9,40 11	10,59 89	9,98 66	52	
	9	9,38 82	9,40 16	10,59 84	9,98 66	51	
4	**10**	9,38 87	9,40 21	10,59 79	9,98 66	**50**	**75**
	11	9,38 92	9,40 27	10,59 73	9,98 66	49	
	12	9,38 97	9,40 32	10,59 68	9,98 65	48	
	13	9,39 02	9,40 37	10,59 63	9,98 65	47	
	14	9,39 07	9,40 42	10,59 57	9,98 65	46	
	15	9,39 12	9,40 48	10,59 52	9,98 64	45	
	16	9,39 17	9,40 53	10,59 47	9,98 64	44	
	17	9,39 22	9,40 58	10,59 42	9,98 64	43	
	18	9,39 27	9,40 64	10,59 36	9,98 63	42	
	19	9,39 32	9,40 69	10,59 31	9,98 63	41	
4	**20**	9,39 37	9,40 74	10,59 26	9,98 63	**40**	**75**
	21	9,39 42	9,40 79	10,59 20	9,98 62	39	
	22	9,39 47	9,40 85	10,59 15	9,98 62	38	
	23	9,39 52	9,40 90	10,59 10	9,98 62	37	
	24	9,39 57	9,40 95	10,59 05	9,98 61	36	
	25	9,39 61	9,41 00	10,58 99	9,98 61	35	
	26	9,39 66	9,41 06	10,58 94	9,98 61	34	
	27	9,39 71	9,41 11	10,58 89	9,98 60	33	
	28	9,39 76	9,41 16	10,58 84	9,98 60	32	
	29	9,39 81	9,41 21	10,58 79	9,98 60	31	
4	**30**	9,39 86	9,41 27	10,58 73	9,98 59	**30**	**75**
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	′
14	30	9,39 86	9,41 27	10,58 73	9,98 59	30	75
	31	9,39 91	9,41 32	10,58 68	9,98 59	29	
	32	9,39 96	9,41 37	10,58 63	9,98 59	28	
	33	9,40 01	9,41 42	10,58 58	9,98 58	27	
	34	9,40 05	9,41 47	10,58 53	9,98 58	26	
	35	9,40 10	9,41 53	10,58 47	9,98 56	25	
	36	9,40 15	9,41 58	10,58 42	9,98 57	24	
	37	9,40 20	9,41 63	10,58 37	9,98 57	23	
	38	9,40 25	9,41 68	10,58 32	9,98 57	22	
	39	9,40 30	9,41 73	10,58 27	9,98 56	21	
14	40	9,40 35	9,41 78	10,58 22	9,98 56	20	75
	41	9,40 39	9,41 84	10,58 16	9,98 56	19	
	42	9,40 44	9,41 89	10,58 11	9,98 55	18	
	43	9,40 49	9,41 94	10,58 06	9,98 55	17	
	44	9,40 54	9,41 99	10,58 01	9,98 55	16	
	45	9,40 59	9,42 04	10,57 96	9,98 54	15	
	46	9,40 63	9,42 09	10,57 91	9,98 54	14	
	47	9,40 68	9,42 14	10,57 86	9,98 54	13	
	48	9,40 73	9,42 19	10,57 80	9,98 53	12	
	49	9,40 78	9,42 25	10,57 75	9,98 53	11	
14	50	9,40 82	9,42 30	10,57 70	9,98 53	10	75
	51	9,40 87	9,42 35	10,57 65	9,98 52	9	
	52	9,40 92	9,42 40	10,57 60	9,98 52	8	
	53	9,40 97	9,42 45	10,57 55	9,98 52	7	
	54	9,41 02	9,42 50	10,57 50	9,98 51	6	
	55	9,41 06	9,42 55	10,57 45	9,98 51	5	
	56	9,41 11	9,42 60	10,57 40	9,98 51	4	
	57	9,41 16	9,42 65	10,57 35	9,98 50	3	
	58	9,41 20	9,42 70	10,57 30	9,98 50	2	
	59	9,41 25	9,42 75	10,57 24	9,98 50	1	
15	0	9,41 30	9,42 80	10,57 19	9,98 49	0	75
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
15	0	9,41 30	9,42 80	10,57 19	9,98 49	0	75
	1	9,41 35	9,42 86	10,57 14	9,98 49	59	
	2	9,41 39	9,42 91	10,57 09	9,98 49	58	
	3	9,41 44	9,42 96	10,57 04	9,98 48	57	
	4	9,41 49	9,43 01	10,56 99	9,98 48	56	
	5	9,41 53	9,43 06	10,56 94	9,98 48	55	
	6	9,41 58	9,43 11	10,56 89	9,98 47	54	
	7	9,41 63	9,43 16	10,56 84	9,98 47	53	
	8	9,41 67	9,43 21	10,56 79	9,98 47	52	
	9	9,41 72	9,43 26	10,56 74	9,98 46	51	
15	10	9,41 77	9,43 31	10,56 69	9,98 46	50	74
	11	9,41 81	9,43 36	10,56 64	9,98 46	49	
	12	9,41 86	9,43 41	10,56 59	9,98 45	48	
	13	9,41 91	9,43 46	10,56 54	9,98 45	47	
	14	9,41 95	9,43 51	10,56 49	9,98 45	46	
	15	9,42 00	9,43 56	10,56 44	9,98 44	45	
	16	9,42 05	9,43 61	10,56 39	9,98 44	44	
	17	9,42 09	9,43 66	10,56 34	9,98 44	43	
	18	9,42 14	9,43 71	10,56 29	9,98 43	42	
	19	9,42 19	9,43 76	10,56 24	9,98 43	41	
15	20	9,42 23	9,43 81	10,56 19	9,98 43	40	74
	21	9,42 28	9,43 85	10,56 14	9,98 42	39	
	22	9,42 32	9,43 90	10,56 09	9,98 42	38	
	23	9,42 37	9,43 95	10,56 05	9,98 41	37	
	24	9,42 42	9,44 00	10,56 00	9,98 41	36	
	25	9,42 46	9,44 05	10,55 95	9,98 41	35	
	26	9,42 51	9,44 10	10,55 90	9,98 40	34	
	27	9,42 55	9,44 15	10,55 85	9,98 40	33	
	28	9,42 60	9,44 20	10,55 80	9,98 40	32	
	29	9,42 64	9,44 25	10,55 75	9,98 39	31	
15	30	9,42 69	9,44 30	10,55 70	9,98 39	30	74
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.		
15	30	9.42 69	9.44 30	10.55 70	9.98 39	30	74
	31	9.42 73	9.44 35	10.55 65	9.98 39	29	
	32	9.42 78	9.44 40	10.55 60	9.98 38	28	
	33	9.42 83	9.44 45	10.55 55	9.98 38	27	
	34	9.42 87	9.44 49	10.55 50	9.98 38	26	
	35	9.42 92	9.44 54	10.55 46	9.98 37	25	
	36	9.42 96	9.44 59	10.55 41	9.98 37	24	
	37	9.43 01	9.44 64	10.55 36	9.98 37	23	
	38	9.43 05	9.44 69	10.55 31	9.98 36	22	
	39	9.43 10	9.44 74	10.55 26	9.98 36	21	
15	40	9.43 14	9.44 79	10.55 21	9.98 36	20	74
	41	9.43 19	9.44 84	10.55 16	9.98 35	19	
	42	9.43 23	9.44 88	10.55 12	9.98 35	18	
	43	9.43 28	9.44 93	10.55 07	9.98 34	17	
	44	9.43 32	9.44 98	10.55 02	9.98 34	16	
	45	9.43 37	9.45 03	10.54 97	9.98 34	15	
	46	9.43 41	9.45 08	10.54 92	9.98 33	14	
	47	9.43 46	9.45 13	10.54 87	9.98 33	13	
	48	9.43 50	9.45 17	10.54 83	9.98 33	12	
	49	9.43 55	9.45 22	10.54 78	9.98 32	11	
15	50	9.43 59	9.45 27	10.54 73	9.98 32	10	74
	51	9.43 63	9.45 32	10.54 68	9.98 32	9	
	52	9.43 68	9.45 37	10.54 63	9.98 31	8	
	53	9.43 72	9.45 41	10.54 58	9.98 31	7	
	54	9.43 77	9.45 46	10.54 54	9.98 31	6	
	55	9.43 81	9.45 51	10.54 49	9.98 30	5	
	56	9.43 85	9.45 56	10.54 44	9.98 30	4	
	57	9.43 90	9.45 61	10.54 39	9.98 29	3	
	58	9.43 95	9.45 65	10.54 35	9.98 29	2	
	59	9.43 99	9.45 70	10.54 30	9.98 29	1	
16	0	9.44 03	9.45 75	10.54 25	9.98 28	0	74
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
16	0	9,44 03	9,45 75	10,54 25	9,98 28	0	74
	1	9,44 08	9,45 80	10,54 20	9,98 28	59	
	2	9,44 12	9,45 84	10,54 15	9,98 28	58	
	3	9,44 17	9,45 89	10,54 11	9,98 27	57	
	4	9,44 21	9,45 94	10,54 06	9,98 27	56	
	5	9,44 25	9,45 99	10,54 01	9,98 27	55	
	6	9,44 30	9,46 03	10,53 96	9,98 26	54	
	7	9,44 34	9,46 08	10,53 92	9,98 26	53	
	8	9,44 38	9,46 13	10,53 87	9,98 25	52	
	9	9,44 43	9,46 18	10,53 82	9,98 25	51	
16	10	9,44 47	9,46 22	10,53 78	9,98 25	50	73
	11	9,44 52	9,46 27	10,53 73	9,98 24	49	
	12	9,44 56	9,46 32	10,53 68	9,98 24	48	
	13	9,44 60	9,46 37	10,53 63	9,98 24	47	
	14	9,44 65	9,46 41	10,53 59	9,98 23	46	
	15	9,44 69	9,46 46	10,53 54	9,98 23	45	
	16	9,44 73	9,46 51	10,53 49	9,98 23	44	
	17	9,44 78	9,46 55	10,53 45	9,98 22	43	
	18	9,44 82	9,46 60	10,53 40	9,98 22	42	
	19	9,44 86	9,46 65	10,53 35	9,98 21	41	
16	20	9,44 90	9,46 69	10,53 31	9,98 21	40	73
	21	9,44 95	9,46 74	10,53 26	9,98 21	39	
	22	9,44 99	9,46 79	10,53 21	9,98 20	38	
	23	9,45 03	9,46 83	10,53 16	9,98 20	37	
	24	9,45 08	9,46 88	10,53 12	9,98 20	36	
	25	9,45 12	9,46 93	10,53 07	9,98 19	35	
	26	9,45 16	9,46 97	10,53 02	9,98 19	34	
	27	9,45 21	9,47 02	10,52 98	9,98 18	33	
	28	9,45 25	9,47 07	10,52 93	9,98 18	32	
	29	9,45 29	9,47 11	10,52 89	9,98 18	31	
16	30	9,45 33	9,47 16	10,52 84	9,98 17	30	73
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	″
16	30	9,45 33	9,47 16	10,52 84	9,98 17	30	73
	31	9,45 38	9,47 21	10,52 79	9,98 17	29	
	32	9,45 42	9,47 25	10,52 75	9,98 17	28	
	33	9,45 46	9,47 30	10,52 70	9,98 16	27	
	34	9,45 50	9,47 35	10,52 65	9,98 16	26	
	35	9,45 55	9,47 39	10,52 61	9,98 15	25	
	36	9,45 59	9,47 44	10,52 56	9,98 15	24	
	37	9,45 63	9,47 48	10,52 52	9,98 15	23	
	38	9,45 67	9,47 53	10,52 47	9,98 14	22	
	39	9,45 72	9,47 58	10,52 42	9,98 14	21	
16	40	9,45 76	9,47 62	10,52 38	9,98 14	20	73
	41	9,45 80	9,47 67	10,52 33	9,98 13	19	
	42	9,45 84	9,47 71	10,52 29	9,98 13	18	
	43	9,45 88	9,47 76	10,52 24	9,98 12	17	
	44	9,45 93	9,47 81	10,52 19	9,98 12	16	
	45	9,45 97	9,47 85	10,52 15	9,98 12	15	
	46	9,46 01	9,47 90	10,52 10	9,98 11	14	
	47	9,46 05	9,47 94	10,52 06	9,98 11	13	
	48	9,46 09	9,47 99	10,52 01	9,98 11	12	
	49	9,46 14	9,48 03	10,51 96	9,98 10	11	
16	50	9,46 18	9,48 08	10,51 92	9,98 10	10	73
	51	9,46 22	9,48 13	10,51 87	9,98 09	9	
	52	9,46 26	9,48 17	10,51 83	9,98 09	8	
	53	9,46 30	9,48 22	10,51 78	9,98 09	7	
	54	9,46 34	9,48 26	10,51 74	9,98 08	6	
	55	9,46 39	9,48 31	10,51 69	9,98 08	5	
	56	9,46 43	9,48 35	10,51 65	9,98 07	4	
	57	9,46 47	9,48 40	10,51 60	9,98 07	3	
	58	9,46 51	9,48 44	10,51 56	9,98 07	2	
	59	9,46 55	9,48 49	10,51 51	9,98 06	1	
17	0	9,46 59	9,48 53	10,51 47	9,98 06	0	73
	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

M.	log sin.	log tang.	log cotg.	log cos.	′	°
0	9,46 59	9,48 53	10,51 47	9,98 06	**0**	**73**
1	9,46 63	9,48 58	10,51 42	9,98 06	59	
2	9,46 68	9,48 62	10,51 38	9,98 05	58	
3	9,46 72	9,48 67	10,51 33	9,98 05	57	
4	9,46 76	9,48 71	10,51 29	9,98 04	56	
5	9,46 80	9,48 76	10,51 24	9,98 04	55	
6	9,46 84	9,48 80	10,51 20	9,98 04	54	
7	9,46 88	9,48 85	10,51 15	9,98 03	53	
8	9,46 92	9,48 89	10,51 11	9,98 03	52	
9	9,46 96	9,48 94	10,51 06	9,98 02	51	
10	9,47 00	9,48 98	10,51 02	9,98 02	**50**	**72**
11	9,47 04	9,49 03	10,50 97	9,98 02	49	
12	9,47 09	9,49 07	10,50 93	9,98 01	48	
13	9,47 13	9,49 12	10,50 88	9,98 01	47	
14	9,47 17	9,49 16	10,50 84	9,98 00	46	
15	9,47 21	9,49 21	10,50 79	9,98 00	45	
16	9,47 25	9,49 25	10,50 75	9,98 00	44	
17	9,47 29	9,49 30	10,50 70	9,97 99	43	
18	9,47 33	9,49 34	10,50 66	9,97 99	42	
19	9,47 37	9,49 38	10,50 61	9,97 99	41	
20	9,47 41	9,49 43	10,50 57	9,97 98	**40**	**72**
21	9,47 45	9,49 47	10,50 53	9,97 98	39	
22	9,47 49	9,49 52	10,50 48	9,97 97	38	
23	9,47 53	9,49 56	10,50 44	9,97 97	37	
24	9,47 57	9,49 61	10,50 39	9,97 97	36	
25	9,47 61	9,49 65	10,50 35	9,97 96	35	
26	9,47 65	9,49 70	10,50 30	9,97 96	34	
27	9,47 69	9,49 74	10,50 26	9,97 95	33	
28	9,47 73	9,49 78	10,50 22	9,97 95	32	
29	9,47 77	9,49 83	10,50 17	9,97 95	31	
30	9,47 81	9,49 87	10,50 13	9,97 94	**30**	**72**
′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log
17	30	9,47 81	9,49 87	10,50 13	9,97
	31	9,47 85	9,49 92	10,50 08	9,97
	32	9,47 89	9,49 96	10,50 04	9,97
	33	9,47 93	9,50 00	10,50 00	9,97
	34	9,47 97	9,50 05	10,49 95	9,97
	35	9,48 01	9,50 09	10,49 91	9,97
	36	9,48 05	9,50 14	10,49 86	9,97
	37	9,48 09	9,50 18	10,49 82	9,97
	38	9,48 13	9,50 22	10,49 78	9,97
	39	9,48 17	9,50 27	10,49 73	9,97
17	40	9,48 21	9,50 31	10,49 69	9,97
	41	9,48 25	9,50 35	10,49 64	9,97
	42	9,48 29	9,50 40	10,49 60	9,97
	43	9,48 33	9,50 44	10,49 56	9,97
	44	9,48 37	9,50 48	10,49 51	9,97
	45	9,48 41	9,50 53	10,49 47	9,97
	46	9,48 45	9,50 57	10,49 43	9,97
	47	9,48 49	9,50 62	10,49 38	9,97
	48	9,48 53	9,50 66	10,49 34	9,97
	49	9,48 57	9,50 70	10,49 30	9,97
17	50	9,48 61	9,50 75	10,49 25	9,97
	51	9,48 65	9,50 79	10,49 21	9,97
	52	9,48 69	9,50 83	10,49 17	9,97
	53	9,48 72	9,50 88	10,49 12	9,97
	54	9,48 76	9,50 92	10,49 08	9,97
	55	9,48 80	9,50 96	10,49 04	9,97
	56	9,48 84	9,51 00	10,48 99	9,97
	57	9,48 88	9,51 05	10,48 95	9,97
	58	9,48 92	9,51 09	10,48 91	9,97
	59	9,48 96	9,51 13	10,48 86	9,97
18	0	9,49 00	9,51 18	10,48 82	9,97
°	′	log cos.	log cotg.	log tang.	log

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
18	0	9,49 00	9,51 18	10,48 82	9,97 82	0	72
	1	9,49 04	9,51 22	10,48 78	9,97 82	59	
	2	9,49 08	9,51 26	10,48 74	9,97 81	58	
	3	9,49 11	9,51 31	10,48 69	9,97 81	57	
	4	9,49 15	9,51 35	10,48 65	9,97 80	56	
	5	9,49 19	9,51 39	10,48 61	9,97 80	55	
	6	9,49 23	9,51 43	10,48 56	9,97 80	54	
	7	9,49 27	9,51 48	10,48 52	9,97 79	53	
	8	9,49 31	9,51 52	10,48 48	9,97 79	52	
	9	9,49 35	9,51 56	10,48 44	9,97 78	51	
18	10	9,49 38	9,51 61	10,48 39	9,97 78	50	71
	11	9,49 42	9,51 65	10,48 35	9,97 77	49	
	12	9,49 46	9,51 69	10,48 31	9,97 77	48	
	13	9,49 50	9,51 73	10,48 27	9,97 77	47	
	14	9,49 54	9,51 78	10,48 22	9,97 76	46	
	15	9,49 58	9,51 82	10,48 18	9,97 76	45	
	16	9,49 61	9,51 86	10,48 14	9,97 75	44	
	17	9,49 65	9,51 90	10,48 10	9,97 75	43	
	18	9,49 69	9,51 95	10,48 05	9,97 75	42	
	19	9,49 73	9,51 99	10,48 01	9,97 74	41	
18	20	9,49 77	9,52 03	10,47 97	9,97 74	40	71
	21	9,49 81	9,52 07	10,47 93	9,97 73	39	
	22	9,49 84	9,52 11	10,47 88	9,97 73	38	
	23	9,49 88	9,52 16	10,47 84	9,97 72	37	
	24	9,49 92	9,52 20	10,47 80	9,97 72	36	
	25	9,49 96	9,52 24	10,47 76	9,97 72	35	
	26	9,50 00	9,52 28	10,47 72	9,97 71	34	
	27	9,50 03	9,52 33	10,47 67	9,97 71	33	
	28	9,50 07	9,52 37	10,47 63	9,97 70	32	
	29	9,50 11	9,52 41	10,47 59	9,97 70	31	
18	30	9,50 15	9,52 45	10,47 55	9,97 70	30	71
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D	M	log sin.	log tang.	log cotg.	log s
18	30	9,50 15	9,52 45	10,47 55	9,97
	31	9,50 18	9,52 49	10,47 51	9,97
	32	9,50 22	9,52 54	10,47 46	9,97
	33	9,50 26	9,52 58	10,47 42	9,97
	34	9,50 30	9,52 62	10,47 38	9,97
	35	9,50 34	9,52 66	10,47 34	9,97
	36	9,50 37	9,52 70	10,47 30	9,97
	37	9,50 41	9,52 74	10,47 25	9,97
	38	9,50 45	9,52 79	10,47 21	9,97
	39	9,50 49	9,52 83	10,47 17	9,97
18	40	9,50 52	9,52 87	10,47 13	9,97
	41	9,50 56	9,52 91	10,47 09	9,97
	42	9,50 60	9,52 95	10,47 05	9,97
	43	9,50 63	9,52 99	10,47 00	9,97
	44	9,50 67	9,53 04	10,46 96	9,97
	45	9,50 71	9,53 08	10,46 92	9,97
	46	9,50 75	9,53 12	10,46 88	9,97
	47	9,50 78	9,53 16	10,46 84	9,97
	48	9,50 82	9,53 20	10,46 80	9,97
	49	9,50 86	9,53 24	10,46 76	9,97
18	50	9,50 90	9,53 28	10,46 71	9,97
	51	9,50 93	9,53 33	10,46 67	9,97
	52	9,50 97	9,53 37	10,46 63	9,97
	53	9,51 01	9,53 41	10,46 59	9,97
	54	9,51 04	9,53 45	10,46 55	9,97
	55	9,51 08	9,53 49	10,46 51	9,97
	56	9,51 12	9,51 53	10,46 47	9,97
	57	9,51 15	9,53 57	10,46 43	9,97
	58	9,51 19	9,53 61	10,46 38	9,97
	59	9,51 23	9,53 66	10,46 34	9,97
19	0	9,51 26	9,53 70	10,46 30	9,97
°	′	log cos.	log cotg.	log tang.	log s

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
9	0	9,51 26	9,53 70	10,46 30	9,97 57	0	71
	1	9,51 30	9,53 74	10,46 26	9,97 56	59	
	2	9,51 34	9,53 78	10,46 22	9,97 56	58	
	3	9,51 37	9,53 82	10,46 18	9,97 55	57	
	4	9,51 41	9,53 86	10,46 14	9,97 55	56	
	5	9,51 45	9,53 90	10,46 10	9,97 54	55	
	6	9,51 48	9,53 94	10,46 06	9,97 54	54	
	7	9,51 52	9,53 98	10,46 02	9,97 54	53	
	8	9,51 56	9,54 02	10,45 97	9,97 53	52	
	9	9,51 59	9,54 06	10,45 93	9,97 53	51	
19	10	9,51 63	9,54 11	10,45 89	9,97 52	50	70
	11	9,51 67	9,54 15	10,45 85	9,97 52	49	
	12	9,51 70	9,54 19	10,45 81	9,97 51	48	
	13	9,51 74	9,54 23	10,45 77	9,97 51	47	
	14	9,51 77	9,54 27	10,45 73	9,97 51	46	
	15	9,51 81	9,54 31	10,45 69	9,97 50	45	
	16	9,51 85	9,54 35	10,45 65	9,97 50	44	
	17	9,51 88	9,54 39	10,45 61	9,97 49	43	
	18	9,51 92	9,54 43	10,45 57	9,97 49	42	
	19	9,51 95	9,54 47	10,45 53	9,97 48	41	
19	20	9,51 99	9,54 51	10,45 49	9,97 48	40	70
	21	9,52 03	9,54 55	10,45 45	9,97 47	39	
	22	9,52 06	9,54 59	10,45 41	9,97 47	38	
	23	9,52 10	9,54 63	10,45 37	9,97 47	37	
	24	9,52 13	9,54 67	10,45 33	9,97 46	36	
	25	9,52 17	9,54 71	10,45 29	9,97 46	35	
	26	9,52 21	9,54 75	10,45 25	9,97 45	34	
	27	9,52 24	9,54 79	10,45 21	9,97 45	33	
	28	9,52 28	9,54 83	10,45 16	9,97 44	32	
	29	9,52 31	9,54 87	10,45 12	9,97 44	31	
19	30	9,52 35	9,54 91	10,45 08	9,97 43	30	70
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	″
19	30	9,52 35	9,54 91	10,45 08	9,97 43	30	70
	31	9,52 38	9,54 95	10,45 04	9,97 43	29	
	32	9,52 42	9,54 99	10,45 00	9,97 43	28	
	33	9,52 46	9,55 03	10,44 96	9,97 42	27	
	34	9,52 49	9,55 07	10,44 92	9,97 42	26	
	35	9,52 53	9,55 11	10,44 88	9,97 41	25	
	36	9,52 56	9,55 15	10,44 84	9,97 41	24	
	37	9,52 60	9,55 19	10,44 80	9,97 40	23	
	38	9,52 63	9,55 23	10,44 76	9,97 40	22	
	39	9,52 67	9,55 27	10,44 72	9,97 39	21	
19	40	9,52 70	9,55 31	10,44 68	9,97 39	20	70
	41	9,52 74	9,55 35	10,44 64	9,97 38	19	
	42	9,52 77	9,55 39	10,44 60	9,97 38	18	
	43	9,52 81	9,55 43	10,44 57	9,97 38	17	
	44	9,52 85	9,55 47	10,44 53	9,97 37	16	
	45	9,52 88	9,55 51	10,44 49	9,97 37	15	
	46	9,52 92	9,55 55	10,44 45	9,97 36	14	
	47	9,52 95	9,55 59	10,44 41	9,97 36	13	
	48	9,52 99	9,55 63	10,44 37	9,97 35	12	
	49	9,53 02	9,55 67	10,44 33	9,97 35	11	
19	50	9,53 06	9,55 71	10,44 29	9,97 34	10	70
	51	9,53 09	9,55 75	10,44 25	9,97 34	9	
	52	9,53 13	9,55 79	10,44 21	9,97 33	8	
	53	9,53 16	9,55 83	10,44 17	9,97 33	7	
	54	9,53 20	9,55 87	10,44 13	9,97 33	6	
	55	9,53 23	9,55 91	10,44 09	9,97 32	5	
	56	9,53 27	9,55 95	10,44 05	9,97 32	4	
	57	9,53 30	9,55 99	10,44 01	9,97 31	3	
	58	9,53 34	9,56 03	10,43 97	9,97 31	2	
	59	9,53 37	9,56 07	10,43 93	9,97 30	1	
20	0	9,53 40	9,56 11	10,43 89	9,97 30	0	70
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
20	0	9,53 40	9,56 11	10,43 89	9,97 30	0	70
	1	9,53 44	9,56 15	10,43 85	9,97 29	59	
	2	9,53 47	9,56 18	10,43 81	9,97 29	58	
	3	9,53 51	9,56 22	10,43 78	9,97 28	57	
	4	9,53 54	9,56 26	10,43 74	9,97 28	56	
	5	9,53 58	9,56 30	10,43 70	9,97 28	55	
	6	9,53 61	9,56 34	10,43 66	9,97 27	54	
	7	9,53 65	9,56 38	10,43 62	9,97 27	53	
	8	9,53 68	9,56 42	10,43 58	9,97 26	52	
	9	9,53 72	9,56 46	10,43 54	9,97 26	51	
20	10	9,53 75	9,56 50	10,43 50	9,97 25	50	69
	11	9,53 78	9,56 54	10,43 46	9,97 25	49	
	12	9,53 82	9,56 58	10,43 42	9,97 24	48	
	13	9,53 85	9,56 61	10,43 38	9,97 24	47	
	14	9,53 89	9,56 65	10,43 35	9,97 23	46	
	15	9,53 92	9,56 69	10,43 31	9,97 23	45	
	16	9,53 96	9,56 73	10,43 27	9,97 22	44	
	17	9,53 99	9,56 77	10,43 23	9,97 22	43	
	18	9,54 02	9,56 81	10,43 19	9,97 21	42	
	19	9,54 06	9,56 85	10,43 15	9,97 21	41	
20	20	9,54 09	9,56 89	10,43 11	9,97 21	40	69
	21	9,54 13	9,56 93	10,43 07	9,97 20	39	
	22	9,54 16	9,56 96	10,43 03	9,97 20	38	
	23	9,54 19	9,57 00	10,43 00	9,97 19	37	
	24	9,54 23	9,57 04	10,42 96	9,97 19	36	
	25	9,54 26	9,57 08	10,42 92	9,97 18	35	
	26	9,54 30	9,57 12	10,42 88	9,97 18	34	
	27	9,54 33	9,57 16	10,42 84	9,97 17	33	
	28	9,54 36	9,57 20	10,42 80	9,97 17	32	
	29	9,54 40	9,57 23	10,42 76	9,97 16	31	
20	30	9,54 43	9,57 27	10,42 73	9,97 16	30	69
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
20	30	9,54 43	9,57 27	10,42 73	9,97 16	30	69
	31	9,54 47	9,57 31	10,42 69	9,97 15	29	
	32	9,54 50	9,57 35	10,42 65	9,97 15	28	
	33	9,54 53	9,57 39	10,42 61	9,97 14	27	
	34	9,54 57	9,57 43	10,42 57	9,97 14	26	
	35	9,54 60	9,57 47	10,42 53	9,97 13	25	
	36	9,54 63	9,57 50	10,42 50	9,97 13	24	
	37	9,54 67	9,57 54	10,42 46	9,97 13	23	
	38	9,54 70	9,57 58	10,42 42	9,97 12	22	
	39	9,54 73	9,57 62	10,42 38	9,97 12	21	
20	40	9,54 77	9,57 66	10,42 34	9,97 11	20	69
	41	9,54 80	9,57 70	10,42 30	9,97 11	19	
	42	9,54 84	9,57 73	10,42 27	9,97 10	18	
	43	9,54 87	9,57 77	10,42 23	9,97 10	17	
	44	9,54 90	9,57 81	10,42 19	9,97 09	16	
	45	9,54 94	9,57 85	10,42 15	9,97 09	15	
	46	9,54 97	9,57 89	10,42 11	9,97 08	14	
	47	9,55 00	9,57 92	10,42 07	9,97 08	13	
	48	9,55 04	9,57 96	10,42 04	9,97 07	12	
	49	9,55 07	9,58 00	10,42 00	9,97 07	11	
20	50	9,55 10	9,58 04	10,41 96	9,97 06	10	69
	51	9,55 14	9,58 08	10,41 92	9,97 06	9	
	52	9,55 17	9,58 11	10,41 88	9,97 05	8	
	53	9,55 20	9,58 15	10,41 85	9,97 05	7	
	54	9,55 23	9,58 19	10,41 81	9,97 04	6	
	55	9,55 27	9,58 23	10,41 77	9,97 04	5	
	56	9,55 30	9,58 27	10,41 73	9,97 03	4	
	57	9,55 33	9,58 30	10,41 70	9,97 03	3	
	58	9,55 37	9,58 34	10,41 66	9,97 02	2	
	59	9,55 40	9,58 38	10,41 62	9,97 02	1	
21	0	9,55 43	9,58 42	10,41 58	9,97 01	0	69
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
21	0	9,55 43	9,58 42	10,41 58	9,97 01	0	69
	1	9,55 47	9,58 45	10,41 54	9,97 01	59	
	2	9,55 50	9,58 49	10,41 51	9,97 00	58	
	3	9,55 53	9,58 53	10,41 47	9,97 00	57	
	4	9,55 56	9,58 57	10,41 43	9,97 00	56	
	5	9,55 60	9,58 61	10,41 39	9,96 99	55	
	6	9,55 63	9,58 64	10,41 36	9,96 99	54	
	7	9,55 66	9,58 68	10,41 32	9,96 98	53	
	8	9,55 69	9,58 72	10,41 28	9,96 98	52	
	9	9,55 73	9,58 76	10,41 24	9,96 97	51	
21	10	9,55 76	9,58 79	10,41 21	9,96 97	50	68
	11	9,55 79	9,58 83	10,41 17	9,96 96	49	
	12	9,55 83	9,58 87	10,41 13	9,96 96	48	
	13	9,55 86	9,58 91	10,41 09	9,96 95	47	
	14	9,55 89	9,58 94	10,41 06	9,96 95	46	
	15	9,55 92	9,58 98	10,41 02	9,96 94	45	
	16	9,55 96	9,59 02	10,40 98	9,96 94	44	
	17	9,55 99	9,59 06	10,40 94	9,96 93	43	
	18	9,56 02	9,59 09	10,40 91	9,96 93	42	
	19	9,56 05	9,59 13	10,40 87	9,96 92	41	
21	20	9,56 08	9,59 17	10,40 83	9,96 92	40	68
	21	9,56 12	9,59 20	10,40 79	9,96 91	39	
	22	9,56 15	9,59 24	10,40 76	9,96 91	38	
	23	9,56 18	9,59 28	10,40 72	9,96 90	37	
	24	9,56 21	9,59 32	10,40 68	9,96 90	36	
	25	9,56 25	9,59 35	10,40 65	9,96 89	35	
	26	9,56 28	9,59 39	10,40 61	9,96 89	34	
	27	9,56 31	9,59 43	10,40 57	9,96 88	33	
	28	9,56 34	9,59 47	10,40 53	9,96 88	32	
	29	9,56 37	9,59 50	10,40 50	9,96 87	31	
21	30	9,56 41	9,59 54	10,40 46	9,96 87	30	68
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	″
21	30	9,56 41	9,59 54	10,40 46	9,96 87	30	68
	31	9,56 44	9,59 58	10,40 42	9,96 86	29	
	32	9,56 47	9,59 61	10,40 39	9,96 86	28	
	33	9,56 50	9,59 65	10,40 35	9,96 85	27	
	34	9,56 54	9,59 69	10,40 31	9,96 85	26	
	35	9,56 57	9,59 72	10,40 27	9,96 84	25	
	36	9,56 60	9,59 76	10,40 24	9,96 84	24	
	37	9,56 63	9,59 80	10,40 20	9,96 83	23	
	38	9,56 66	9,59 83	10,40 16	9,96 83	22	
	39	9,56 69	9,59 87	10,40 13	9,96 82	21	
21	40	9,56 73	9,59 91	10,40 09	9,96 82	20	68
	41	9,56 76	9,59 95	10,40 05	9,96 81	19	
	42	9,56 79	9,59 98	10,40 02	9,96 81	18	
	43	9,56 82	9,60 02	10,39 98	9,96 80	17	
	44	9,56 85	9,60 06	10,39 94	9,96 80	16	
	45	9,56 89	9,60 09	10,39 91	9,96 79	15	
	46	9,56 92	9,60 13	10,39 87	9,96 79	14	
	47	9,56 95	9,60 17	10,39 83	9,96 78	13	
	48	9,56 98	9,60 20	10,39 80	9,96 78	12	
	49	9,57 01	9,60 24	10,39 76	9,96 77	11	
21	50	9,57 04	9,60 28	10,39 72	9,96 77	10	68
	51	9,57 07	9,60 31	10,39 69	9,96 76	9	
	52	9,57 11	9,60 35	10,39 65	9,96 76	8	
	53	9,57 14	9,60 39	10,39 61	9,96 75	7	
	54	9,57 17	9,60 42	10,39 58	9,96 75	6	
	55	9,57 20	9,60 46	10,39 54	9,96 74	5	
	56	9,57 23	9,60 49	10,39 50	9,96 74	4	
	57	9,57 26	9,60 53	10,39 47	9,96 73	3	
	58	9,57 29	9,60 57	10,39 43	9,96 73	2	
	59	9,57 33	9,60 60	10,39 39	9,96 72	1	
22	0	9,57 36	9,60 64	10,39 36	9,96 72	0	68
″	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
22	**0**	9,57 36	9,60 64	10,39 36	9,96 72	**0**	**68**
	1	9,57 39	9,60 68	10,39 32	9,96 71	59	
	2	9,57 42	9,60 71	10,39 29	9,96 71	58	
	3	9,57 45	9,60 75	10,39 25	9,96 70	57	
	4	9,57 48	9,60 79	10,39 21	9,96 70	56	
	5	9,57 51	9,60 82	10,39 18	9,96 69	55	
	6	9,57 54	9,60 86	10,39 14	9,96 69	54	
	7	9,57 58	9,60 89	10,39 10	9,96 68	53	
	8	9,57 61	9,60 93	10,39 07	9,96 68	52	
	9	9,57 64	9,60 97	10,39 03	9,96 67	51	
22	**10**	9,57 67	9,61 00	10,39 00	9,96 66	**50**	**67**
	11	9,57 70	9,61 04	10,38 96	9,96 66	49	
	12	9,57 73	9,61 08	10,38 92	9,96 65	48	
	13	9,57 76	9,61 11	10,38 89	9,96 65	47	
	14	9,57 79	9,61 15	10,38 85	9,96 64	46	
	15	9,57 82	9,61 18	10,38 82	9,96 64	45	
	16	9,57 85	9,61 22	10,38 78	9,96 63	44	
	17	9,57 88	9,61 26	10,38 74	9,96 63	43	
	18	9,57 92	9,61 29	10,38 71	9,96 62	42	
	19	9,57 95	9,61 33	10,38 67	9,96 62	41	
22	**20**	9,57 98	9,61 36	10,38 64	9,96 61	**40**	**67**
	21	9,58 01	9,61 40	10,38 60	9,96 61	39	
	22	9,58 04	9,61 44	10,38 56	9,96 60	38	
	23	9,58 07	9,61 47	10,38 53	9,96 60	37	
	24	9,58 10	9,61 51	10,38 49	9,96 59	36	
	25	9,58 13	9,61 54	10,38 46	9,96 59	35	
	26	9,58 16	9,61 58	10,38 42	9,96 58	34	
	27	9,58 19	9,61 61	10,38 38	9,96 58	33	
	28	9,58 22	9,61 65	10,38 35	9,96 57	32	
	29	9,58 25	9,61 69	10,38 31	9,96 57	31	
22	**30**	9,58 28	9,61 72	10,38 28	9,96 56	**30**	**67**
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log co
22	30	9,58 28	9,61 72	10,38
	31	9,58 31	9,61 76	10,38
	32	9,58 34	9,61 79	10,38
	33	9,58 37	9,61 83	10,38
	34	9,58 41	9,61 86	10,38
	35	9,58 44	9,61 90	10,38
	36	9,58 47	9,61 94	10,38
	37	9,58 50	9,61 97	10,38
	38	9,58 53	9,62 01	10,37
	39	9,58 56	9,62 04	10,37
22	40	9,58 59	9,62 08	10,37
	41	9,58 62	9,62 11	10,37
	42	9,58 65	9,62 15	10,37
	43	9,58 68	9,62 18	10,37
	44	9,58 71	9,62 22	10,37
	45	9,58 74	9,62 26	10,37
	46	9,58 77	9,62 29	10,37
	47	9,58 80	9,62 33	10,37
	48	9,58 83	9,62 36	10,37
	49	9,58 86	9,62 40	10,37
22	50	9,58 89	9,62 43	10,37
	51	9,58 92	9,62 47	10,37
	52	9,58 95	9,62 50	10,37
	53	9,58 98	9,62 54	10,37
	54	9,59 01	9,62 57	10,37
	55	9,59 04	9,62 61	10,37
	56	9,59 07	9,62 64	10,37
	57	9,59 10	9,62 68	10,37
	58	9,59 13	9,62 71	10,37
	59	9,59 16	9,62 75	10,37
23	0	9,59 19	9,62 78	10,37
°	′	log cos.	log cotg.	log tan

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
23	0	9,59 19	9,62 78	10,37 21	9,96 40	0	67
	1	9,59 22	9,62 82	10,37 18	9,96 40	59	
	2	9,59 25	9,62 85	10,37 14	9,96 39	58	
	3	9,59 28	9,62 89	10,37 11	9,96 39	57	
	4	9,59 31	9,62 93	10,37 07	9,96 38	56	
	5	9,59 34	9,62 96	10,37 04	9,96 38	55	
	6	9,59 37	9,63 00	10,37 00	9,96 37	54	
	7	9,59 40	9,63 03	10,36 97	9,96 36	53	
	8	9,59 42	9,63 07	10,36 93	9,96 36	52	
	9	9,59 45	9,63 10	10,36 90	9,96 35	51	
23	10	9,59 48	9,63 13	10,36 86	9,96 35	50	66
	11	9,59 51	9,63 17	10,36 83	9,96 34	49	
	12	9,59 54	9,63 20	10,36 79	9,96 34	48	
	13	9,59 57	9,63 24	10,36 76	9,96 33	47	
	14	9,59 60	9,63 27	10,36 72	9,96 33	46	
	15	9,59 63	9,63 31	10,36 69	9,96 32	45	
	16	9,59 66	9,63 34	10,36 65	9,96 32	44	
	17	9,59 69	9,63 38	10,36 62	9,96 31	43	
	18	9,59 72	9,63 41	10,36 59	9,96 30	42	
	19	9,59 75	9,63 45	10,36 55	9,96 30	41	
23	20	9,59 78	9,63 48	10,36 52	9,96 29	40	66
	21	9,59 81	9,63 52	10,36 48	9,96 29	39	
	22	9,59 84	9,63 55	10,36 45	9,96 28	38	
	23	9,59 87	9,63 59	10,36 41	9,96 28	37	
	24	9,59 89	9,63 62	10,36 38	9,96 27	36	
	25	9,59 92	9,63 66	10,36 34	9,96 27	35	
	26	9,59 95	9,63 69	10,36 31	9,96 26	34	
	27	9,59 98	9,63 73	10,36 27	9,96 26	33	
	28	9,60 01	9,63 76	10,36 24	9,96 25	32	
	29	9,60 04	9,63 80	10,36 20	9,96 24	31	
23	30	9,60 07	9,63 83	10,36 17	9,96 24	30	66
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
23	30	9,60 07	9,63 83	10,36 17	9,96 24	30	6(
	31	9,60 10	9,63 86	10,36 13	9,96 23	29	
	32	9,60 13	9,63 90	10,36 10	9,96 23	28	
	33	9,60 16	9,63 93	10,36 07	9,96 22	27	
	34	9,60 19	9,63 97	10,36 03	9,96 22	26	
	35	9,60 21	9,64 00	10,36 00	9,96 21	25	
	36	9,60 24	9,64 04	10,35 96	9,96 21	24	
	37	9,60 27	9,64 07	10,35 93	9,96 20	23	
	38	9,60 30	9,64 11	10,35 89	9,96 20	22	
	39	9,60 33	9,64 14	10,35 86	9,96 19	21	
23	40	9,60 36	9,64 17	10,35 82	9,96 18	20	6(
	41	9,60 39	9,64 21	10,35 79	9,96 18	19	
	42	9,60 42	9,64 24	10,35 76	9,96 17	18	
	43	9,60 45	9,64 28	10,35 72	9,96 17	17	
	44	9,60 47	9,64 31	10,35 69	9,96 16	16	
	45	9,60 50	9,64 35	10,35 65	9,96 16	15	
	46	9,60 53	9,64 38	10,35 62	9,96 15	14	
	47	9,60 56	9,64 41	10,35 58	9,96 15	13	
	48	9,60 59	9,64 45	10,35 55	9,96 14	12	
	49	9,60 62	9,64 48	10,35 52	9,96 13	11	
23	50	9,60 65	9,64 52	10,35 48	9,96 13	10	6(
	51	9,60 67	9,64 55	10,35 45	9,96 12	9	
	52	9,60 70	9,64 59	10,35 41	9,96 12	8	
	53	9,60 73	9,64 62	10,35 38	9,96 11	7	
	54	9,60 76	9,64 65	10,35 35	9,96 11	6	
	55	9,60 79	9,64 69	10,35 31	9,96 10	5	
	56	9,60 82	9,64 72	10,35 28	9,96 09	4	
	57	9,60 85	9,64 76	10,35 24	9,96 09	3	
	58	9,60 87	9,64 79	10,35 21	9,96 08	2	
	59	9,60 90	9,64 82	10,35 18	9,96 08	1	
24	0	9,60 93	9,64 86	10,35 14	9,96 07	0	6(
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

M.	log sin.	log tang.	log cotg.	log cos.	′	°
0	9,60 93	9,64 86	10,35 14	9,96 07	**0**	**66**
1	9,60 96	9,64 89	10,35 11	9,96 07	59	
2	9,60 99	9,64 93	10,35 07	9,96 06	58	
3	9,61 02	9,64 96	10,35 04	9,96 06	57	
4	9,61 04	9,64 99	10,35 01	9,96 05	56	
5	9,61 07	9,65 03	10,34 97	9,96 04	55	
6	9,61 10	9,65 06	10,34 94	9,96 04	54	
7	9,61 13	9,65 10	10,34 90	9,96 03	53	
8	9,61 16	9,65 13	10,34 87	9,96 03	52	
9	9,61 19	9,65 16	10,34 84	9,96 02	51	
10	9,61 21	9,65 20	10,34 80	9,96 02	**50**	**65**
11	9,61 24	9,65 23	10,34 77	9,96 01	49	
12	9,61 27	9,65 26	10,34 73	9,96 00	48	
13	9,61 30	9,65 30	10,34 70	9,96 00	47	
14	9,61 33	9,65 33	10,34 67	9,95 99	46	
15	9,61 35	9,65 37	10,34 63	9,95 99	45	
16	9,61 38	9,65 40	10,34 60	9,95 98	44	
17	9,61 41	9,65 43	10,34 57	9,95 98	43	
18	9,61 44	9,65 47	10,34 53	9,95 97	42	
19	9,61 47	9,65 50	10,34 50	9,95 96	41	
20	9,61 49	9,65 53	10,34 46	9,95 96	**40**	**65**
21	9,61 52	9,65 57	10,34 43	9,95 95	39	
22	9,61 55	9,65 60	10,34 40	9,95 95	38	
23	9,61 58	9,65 64	10,34 36	9,95 94	37	
24	9,61 61	9,65 67	10,34 33	9,95 94	36	
25	9,61 63	9,65 70	10,34 30	9,95 93	35	
26	9,61 66	9,65 74	10,34 26	9,95 92	34	
27	9,61 69	9,65 77	10,34 23	9,95 92	33	
28	9,61 72	9,65 80	10,34 20	9,95 91	32	
29	9,61 74	9,65 84	10,34 16	9,95 91	31	
30	9,61 77	9,65 87	10,34 13	9,95 90	**30**	**65**
′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
24	30	9,61 77	9,65 87	10,34 13	9,95 90	30	6
	31	9,61 80	9,65 90	10,34 10	9,95 90	29	
	32	9,61 83	9,65 94	10,34 06	9,95 89	28	
	33	9,61 86	9,65 97	10,34 03	9,95 88	27	
	34	9,61 88	9,66 00	10,34 00	9,95 88	26	
	35	9,61 91	9,66 04	10,33 96	9,95 87	25	
	36	9,61 94	9,66 07	10,33 93	9,95 87	24	
	37	9,61 97	9,66 10	10,33 90	9,95 86	23	
	38	9,61 99	9,66 14	10,33 86	9,95 86	22	
	39	9,62 02	9,66 17	10,33 83	9,95 85	21	
24	40	9,62 05	9,66 20	10,33 80	9,95 84	20	6
	41	9,62 08	9,66 24	10,33 76	9,95 84	19	
	42	9,62 10	9,66 27	10,33 73	9,95 83	18	
	43	9,62 13	9,66 30	10,33 70	9,95 83	17	
	44	9,62 16	9,66 34	10,33 66	9,95 82	16	
	45	9,62 19	9,66 37	10,33 63	9,95 81	15	
	46	9,62 21	9,66 40	10,33 60	9,95 81	14	
	47	9,62 24	9,66 44	10,33 56	9,95 80	13	
	48	9,62 27	9,66 47	10,33 53	9,95 80	12	
	49	9,62 30	9,66 50	10,33 50	9,95 79	11	
24	50	9,62 32	9,66 54	10,33 46	9,95 79	10	6
	51	9,62 35	9,66 57	10,33 43	9,95 78	9	
	52	9,62 38	9,66 60	10,33 40	9,95 77	8	
	53	9,62 40	9,66 64	10,33 36	9,95 77	7	
	54	9,62 43	9,66 67	10,33 33	9,95 76	6	
	55	9,62 46	9,66 70	10,33 30	9,95 76	5	
	56	9,62 49	9,66 73	10,33 26	9,95 75	4	
	57	9,62 51	9,66 77	10,33 23	9,95 74	3	
	58	9,62 54	9,66 80	10,33 20	9,95 74	2	
	59	9,62 57	9,66 83	10,33 17	9,95 73	1	
25	0	9,62 59	9,66 87	10,33 13	9,95 73	0	6
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D

n.	log tang.	log cotg.	log cos.	′	°
59	9,66 87	10,33 13	9,95 73	**0**	**65**
62	9,66 90	10,33 10	9,95 72	59	
65	9,66 93	10,33 07	9,95 72	58	
68	9,66 97	10,33 03	9,95 71	57	
70	9,67 00	10,33 00	9,95 70	56	
73	9,67 03	10,32 97	9,95 70	55	
76	9,67 06	10,32 93	9,95 69	54	
78	9,67 10	10,32 90	9,95 69	53	
81	9,67 13	10,32 87	9,95 68	52	
84	9,67 16	10,32 84	9,95 67	51	
86	9,67 20	10,32 80	9,95 67	**50**	**64**
89	9,67 23	10,32 77	9,95 66	49	
92	9,67 26	10,32 74	9,95 66	48	
94	9,67 29	10,32 70	9,95 65	47	
97	9,67 33	10,32 67	9,95 64	46	
00	9,67 36	10,32 64	9,95 64	45	
03	9,67 39	10,32 61	9,95 63	44	
05	9,67 43	10,32 57	9,95 63	43	
08	9,67 46	10,32 54	9,95 62	42	
11	9,67 49	10,32 51	9,95 61	41	
13	9,67 52	10,32 48	9,95 61	**40**	**64**
16	9,67 56	10,32 44	9,95 60	39	
19	9,67 59	10,32 41	9,95 60	38	
21	9,67 62	10,32 38	9,95 59	37	
24	9,67 65	10,32 35	9,95 58	36	
27	9,67 69	10,32 31	9,95 58	35	
29	9,67 72	10,32 28	9,95 57	34	
32	9,67 75	10,32 25	9,95 57	33	
34	9,67 78	10,32 21	9,95 56	32	
37	9,67 82	10,32 18	9,95 55	31	
40	9,67 85	10,32 15	9,95 55	**30**	**64**
os.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
25	30	9,63 40	9,67 85	10,32 15	9,95 55	30	64
	31	9,63 42	9,67 88	10,32 12	9,95 54	29	
	32	9,63 45	9,67 91	10,32 08	9,95 54	28	
	33	9,63 48	9,67 95	10,32 05	9,95 53	27	
	34	9,63 50	9,67 98	10,32 02	9,95 52	26	
	35	9,63 53	9,68 01	10,31 99	9,95 52	25	
	36	9,63 56	9,68 04	10,31 96	9,95 51	24	
	37	9,63 58	9,68 08	10,31 92	9,95 51	23	
	38	9,63 61	9,68 11	10,31 89	9,95 50	22	
	39	9,63 64	9,68 14	10,31 86	9,95 49	21	
25	40	9,63 66	9,68 17	10,31 83	9,95 49	20	64
	41	9,63 69	9,68 21	10,31 79	9,95 48	19	
	42	9,63 71	9,68 24	10,31 76	9,95 48	18	
	43	9,63 74	9,68 27	10,31 73	9,95 47	17	
	44	9,63 77	9,68 30	10,31 70	9,95 46	16	
	45	9,63 79	9,68 34	10,31 66	9,95 46	15	
	46	9,63 82	9,68 37	10,31 63	9,95 45	14	
	47	9,63 85	9,68 40	10,31 60	9,95 45	13	
	48	9,63 87	9,68 43	10,31 57	9,95 44	12	
	49	9,63 90	9,68 46	10,31 53	9,95 43	11	
25	50	9,63 92	9,68 50	10,31 50	9,95 43	10	64
	51	9,63 95	9,68 53	10,31 47	9,95 42	9	
	52	9,63 98	9,68 56	10,31 44	9,95 41	8	
	53	9,64 00	9,68 59	10,31 41	9,95 41	7	
	54	9,64 03	9,68 63	10,31 37	9,95 40	6	
	55	9,64 05	9,68 66	10,31 34	9,95 40	5	
	56	9,64 08	9,68 69	10,31 31	9,95 39	4	
	57	9,64 11	9,68 72	10,31 28	9,95 38	3	
	58	9,64 13	9,68 75	10,31 25	9,95 38	2	
	59	9,64 16	9,68 79	10,31 21	9,95 37	1	
	0	9,64 18	9,68 82	10,31 18	9,95 37	0	64
		log cos.	log cotg.	log tang.	log sin.	M.	D.

	M.	log sin.	log tang.	log cotg.	log cos.	′	°
	0	9,64 18	9,68 82	10,31 18	9,95 37	**0**	**64**
	1	9,64 21	9,68 85	10,31 15	9,95 36	59	
	2	9,64 24	9,68 88	10,31 12	9,95 35	58	
	3	9,64 26	9,68 91	10,31 09	9,95 35	57	
	4	9,64 29	9,68 95	10,31 05	9,95 34	56	
	5	9,64 31	9,68 98	10,31 02	9,95 33	55	
	6	9,64 34	9,69 01	10,30 99	9,95 33	54	
	7	9,64 36	9,69 04	10,30 96	9,95 32	53	
	8	9,64 39	9,69 07	10,30 93	9,95 32	52	
	9	9,64 42	9,69 11	10,30 89	9,95 31	51	
6	**10**	9,64 44	9,69 14	10,30 86	9,95 30	**50**	**63**
	11	9,64 47	9,69 17	10,30 83	9,95 30	49	
	12	9,64 49	9,69 20	10,30 80	9,95 29	48	
	13	9,64 52	9,69 23	10,30 77	9,95 29	47	
	14	9,64 54	9,69 27	10,30 73	9,95 28	46	
	15	9,64 57	9,69 30	10,30 70	9,95 27	45	
	16	9,64 60	9,69 33	10,30 67	9,95 27	44	
	17	9,64 62	9,69 36	10,30 64	9,95 26	43	
	18	9,64 65	9,69 39	10,30 61	9,95 25	42	
	19	9,64 67	9,69 42	10,30 57	9,95 25	41	
6	**20**	9,64 70	9,69 46	10,30 54	9,95 24	**40**	**63**
	21	9,64 72	9,69 49	10,30 51	9,95 24	39	
	22	9,64 75	9,69 52	10,30 48	9,95 23	38	
	23	9,64 77	9,69 55	10,30 45	9,95 22	37	
	24	9,64 80	9,69 58	10,30 42	9,95 22	36	
	25	9,64 83	9,69 61	10,30 38	9,95 21	35	
	26	9,64 85	9,69 65	10,30 35	9,95 20	34	
	27	9,64 88	9,69 68	10,30 32	9,95 20	33	
	28	9,64 90	9,69 71	10,30 29	9,95 19	32	
	29	9,64 93	9,69 74	10,30 26	9,95 18	31	
6	**30**	9,64 95	9,69 77	10,30 23	9,95 18	**30**	**63**
	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
26	30	9,64 95	9,69 77	10,30 23	9,95 18	30	63
	31	9,64 98	9,69 80	10,30 19	9,95 17	29	
	32	9,65 00	9,69 84	10,30 16	9,95 17	28	
	33	9,65 03	9,69 87	10,30 13	9,95 16	27	
	34	9,65 05	9,69 90	10,30 10	9,95 15	26	
	35	9,65 08	9,69 93	10,30 07	9,95 15	25	
	36	9,65 10	9,69 96	10,30 04	9,95 14	24	
	37	9,65 13	9,69 99	10,30 00	9,95 13	23	
	38	9,65 15	9,70 03	10,29 97	9,95 13	22	
	39	9,65 18	9,70 06	10,29 94	9,95 12	21	
26	40	9,65 20	9,70 09	10,29 91	9,95 12	20	63
	41	9,65 23	9,70 12	10,29 88	9,95 11	19	
	42	9,65 25	9,70 15	10,29 85	9,95 10	18	
	43	9,65 28	9,70 18	10,29 82	9,95 10	17	
	44	9,65 31	9,70 21	10,29 78	9,95 09	16	
	45	9,65 33	9,70 25	10,29 75	9,95 08	15	
	46	9,65 36	9,70 28	10,29 72	9,95 08	14	
	47	9,65 38	9,70 31	10,29 69	9,95 07	13	
	48	9,65 41	9,70 34	10,29 66	9,95 06	12	
	49	9,65 43	9,70 37	10,29 63	9,95 06	11	
26	50	9,65 46	9,70 40	10,29 60	9,95 05	10	63
	51	9,65 48	9,70 43	10,29 56	9,95 05	9	
	52	9,65 51	9,70 47	10,29 53	9,95 04	8	
	53	9,65 53	9,70 50	10,29 50	9,95 03	7	
	54	9,65 56	9,70 53	10,29 47	9,95 03	6	
	55	9,65 58	9,70 56	10,29 44	9,95 02	5	
	56	9,65 60	9,70 59	10,29 41	9,95 01	4	
	57	9,65 63	9,70 62	10,29 38	9,95 01	3	
	58	9,65 65	9,70 65	10,29 35	9,95 00	2	
	59	9,65 68	9,70 68	10,29 31	9,94 99	1	
27	0	9,65 70	9,70 72	10,29 28	9,94 99	0	63
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
27	0	9,65 70	9,70 72	10,29 28	9,94 99	0	63
	1	9,65 73	9,70 75	10,29 25	9,94 98	59	
	2	9,65 75	9,70 78	10,29 22	9,94 97	58	
	3	9,65 78	9,70 81	10,29 19	9,94 97	57	
	4	9,65 80	9,70 84	10,29 16	9,94 96	56	
	5	9,65 83	9,70 87	10,29 13	9,94 96	55	
	6	9,65 85	9,70 90	10,29 10	9,94 95	54	
	7	9,65 88	9,70 93	10,29 06	9,94 94	53	
	8	9,65 90	9,70 97	10,29 03	9,94 94	52	
	9	9,65 93	9,71 00	10,29 00	9,94 93	51	
27	10	9,65 95	9,71 03	10,28 97	9,94 92	50	62
	11	9,65 98	9,71 06	10,28 94	9,94 92	49	
	12	9,66 00	9,71 09	10,28 91	9,94 91	48	
	13	9,66 02	9,71 12	10,28 88	9,94 90	47	
	14	9,66 05	9,71 15	10,28 85	9,94 90	46	
	15	9,66 07	9,71 18	10,28 82	9,94 89	45	
	16	9,66 10	9,71 21	10,28 78	9,94 88	44	
	17	9,66 12	9,71 25	10,28 75	9,94 88	43	
	18	9,66 15	9,71 28	10,28 72	9,94 87	42	
	19	9,66 17	9,71 31	10,28 69	9,94 86	41	
27	20	9,66 20	9,71 34	10,28 66	9,94 86	40	62
	21	9,66 22	9,71 37	10,28 63	9,94 85	39	
	22	9,66 25	9,71 40	10,28 60	9,94 84	38	
	23	9,66 27	9,71 43	10,28 57	9,94 84	37	
	24	9,66 29	9,71 46	10,28 54	9,94 83	36	
	25	9,66 32	9,71 49	10,28 51	9,94 83	35	
	26	9,66 34	9,71 52	10,28 48	9,94 82	34	
	27	9,66 37	9,71 55	10,28 44	9,94 81	33	
	28	9,66 39	9,71 59	10,28 41	9,94 81	32	
	29	9,66 42	9,71 62	10,28 38	9,94 80	31	
27	30	9,66 44	9,71 65	10,28 35	9,94 79	30	62
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	″
27	30	9,66 44	9,71 65	10,28 35	9,94 79	30	62
	31	9,66 46	9,71 68	10,28 32	9,94 79	29	
	32	9,66 49	9,71 71	10,28 29	9,94 78	28	
	33	9,66 51	9,71 74	10,28 26	9,94 77	27	
	34	9,66 54	9,71 77	10,28 23	9,94 77	26	
	35	9,66 56	9,71 80	10,28 20	9,94 76	25	
	36	9,66 59	9,71 83	10,28 17	9,94 75	24	
	37	9,66 61	9,71 86	10,28 14	9,94 75	23	
	38	9,66 63	9,71 89	10,28 11	9,94 74	22	
	39	9,66 66	9,71 92	10,28 07	9,94 73	21	
27	40	9,66 68	9,71 95	10,28 04	9,94 73	20	62
	41	9,66 71	9,71 99	10,28 01	9,94 72	19	
	42	9,66 73	9,72 02	10,27 98	9,94 71	18	
	43	9,66 75	9,72 05	10,27 95	9,94 71	17	
	44	9,66 78	9,72 08	10,27 92	9,94 70	16	
	45	9,66 80	9,72 11	10,27 89	9,94 69	15	
	46	9,66 83	9,72 14	10,27 86	9,94 69	14	
	47	9,66 85	9,72 17	10,27 83	9,94 68	13	
	48	9,66 87	9,72 20	10,27 80	9,94 67	12	
	49	9,66 90	9,72 23	10,27 77	9,94 67	11	
27	50	9,66 92	9,72 26	10,27 74	9,94 66	10	62
	51	9,66 95	9,72 29	10,27 71	9,94 65	9	
	52	9,66 97	9,72 32	10,27 68	9,94 65	8	
	53	9,66 99	9,72 35	10,27 65	9,94 64	7	
	54	9,67 02	9,72 38	10,27 62	9,94 63	6	
	55	9,67 04	9,72 41	10,27 58	9,94 63	5	
	56	9,67 07	9,72 44	10,27 55	9,94 62	4	
	57	9,67 09	9,72 48	10,27 52	9,94 61	3	
	58	9,67 11	9,72 51	10,27 49	9,94 61	2	
	59	9,67 14	9,72 54	10,27 46	9,94 60	1	
28	0	9,67 16	9,72 57	10,27 43	9,94 59	0	62
	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
8	**0**	9,67 16	9,72 57	10,27 43	9,94 59	**0**	**62**
	1	9,67 18	9,72 60	10,27 40	9,94 59	59	
	2	9,67 21	9,72 63	10,27 37	9,94 58	58	
	3	9,67 23	9,72 66	10,27 34	9,94 57	57	
	4	9,67 26	9,72 69	10,27 31	9,94 57	56	
	5	9,67 28	9,72 72	10,27 28	9,94 56	55	
	6	9,67 30	9,72 75	10,27 25	9,94 55	54	
	7	9,67 33	9,72 78	10,27 22	9,94 55	53	
	8	9,67 35	9,72 81	10,27 19	9,94 54	52	
	9	9,67 37	9,72 84	10,27 16	9,94 53	51	
8	**10**	9,67 40	9,72 87	10,27 13	9,94 53	**50**	**61**
	11	9,67 42	9,72 90	10,27 10	9,94 52	49	
	12	9,67 44	9,72 93	10,27 07	9,94 51	48	
	13	9,67 47	9,72 96	10,27 04	9,94 51	47	
	14	9,67 49	9,72 99	10,27 01	9,94 50	46	
	15	9,67 51	9,73 02	10,26 98	9,94 49	45	
	16	9,67 54	9,73 05	10,26 95	9,94 48	44	
	17	9,67 56	9,73 08	10,26 92	9,94 48	43	
	18	9,67 59	9,73 11	10,26 89	9,94 47	42	
	19	9,67 61	9,73 14	10,26 86	9,94 46	41	
8	**20**	9,67 63	9,73 17	10,26 82	9,94 46	**40**	**61**
	21	9,67 66	9,73 20	10,26 79	9,94 45	39	
	22	9,67 68	9,73 23	10,26 76	9,94 44	38	
	23	9,67 70	9,73 26	10,26 73	9,94 44	37	
	24	9,67 73	9,73 29	10,26 70	9,94 43	36	
	25	9,67 75	9,73 33	10,26 67	9,94 42	35	
	26	9,67 77	9,73 36	10,26 64	9,94 42	34	
	27	9,67 80	9,73 39	10,26 61	9,94 41	33	
	28	9,67 82	9,73 42	10,26 58	9,94 40	32	
	29	9,67 84	9,73 45	10,26 55	9,94 40	31	
8	**30**	9,67 87	9,73 48	10,26 52	9,94 39	**30**	**61**
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	″
28	30	9,67 87	9,73 48	10,26 52	9,94 39	30	61
	31	9,67 89	9,73 51	10,26 49	9,94 38	29	
	32	9,67 91	9,73 54	10,26 46	9,94 38	28	
	33	9,67 94	9,73 57	10,26 43	9,94 37	27	
	34	9,67 96	9,73 60	10,26 40	9,94 36	26	
	35	9,67 98	9,73 63	10,26 37	9,94 35	25	
	36	9,68 01	9,73 66	10,26 34	9,94 35	24	
	37	9,68 03	9,73 69	10,26 31	9,94 34	23	
	38	9,68 05	9,73 72	10,26 28	9,94 33	22	
	39	9,68 07	9,73 75	10,26 25	9,94 33	21	
28	40	9,68 10	9,73 78	10,26 22	9,94 32	20	61
	41	9,68 12	9,73 81	10,26 19	9,94 31	19	
	42	9,68 14	9,73 84	10,26 16	9,94 31	18	
	43	9,68 17	9,73 87	10,26 13	9,94 30	17	
	44	9,68 19	9,73 90	10,26 10	9,94 29	16	
	45	9,68 21	9,73 93	10,26 07	9,94 29	15	
	46	9,68 24	9,73 96	10,26 04	9,94 28	14	
	47	9,68 26	9,73 99	10,26 01	9,94 27	13	
	48	9,68 28	9,74 02	10,25 98	9,94 27	12	
	49	9,68 30	9,74 05	10,25 95	9,94 26	11	
28	50	9,68 33	9,74 08	10,25 92	9,94 25	10	61
	51	9,68 35	9,74 11	10,25 89	9,94 24	9	
	52	9,68 37	9,74 14	10,25 86	9,94 24	8	
	53	9,68 40	9,74 17	10,25 83	9,94 23	7	
	54	9,68 42	9,74 20	10,25 80	9,94 22	6	
	55	9,68 44	9,74 23	10,25 77	9,94 22	5	
	56	9,68 47	9,74 26	10,25 74	9,94 21	4	
	57	9,68 49	9,74 29	10,25 71	9,94 20	3	
	58	9,68 51	9,74 32	10,25 68	9,94 20	2	
	59	9,68 53	9,74 34	10,25 65	9,94 19	1	
29	0	9,68 56	9,74 37	10,25 62	9,94 18	0	61
″	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
29	0	9,68 56	9,74 37	10,25 62	9,94 18	0	61
	1	9,68 58	9,74 40	10,25 59	9,94 17	59	
	2	9,68 60	9,74 43	10,25 56	9,94 17	58	
	3	9,68 62	9,74 46	10,25 53	9,94 16	57	
	4	9,68 65	9,74 49	10,25 51	9,94 15	56	
	5	9,68 67	9,74 52	10,25 48	9,94 15	55	
	6	9,68 69	9,74 55	10,25 45	9,94 14	54	
	7	9,68 72	9,74 58	10,25 42	9,94 13	53	
	8	9,68 74	9,74 61	10,25 39	9,94 13	52	
	9	9,68 76	9,74 64	10,25 36	9,94 12	51	
29	10	9,68 78	9,74 67	10,25 33	9,94 11	50	60
	11	9,68 81	9,74 70	10,25 30	9,94 10	49	
	12	9,68 83	9,74 73	10,25 27	9,94 10	48	
	13	9,68 85	9,74 76	10,25 24	9,94 09	47	
	14	9,68 87	9,74 79	10,25 21	9,94 08	46	
	15	9,68 90	9,74 82	10,25 18	9,94 08	45	
	16	9,68 92	9,74 85	10,25 15	9,94 07	44	
	17	9,68 94	9,74 88	10,25 12	9,94 06	43	
	18	9,68 96	9,74 91	10,25 09	9,94 05	42	
	19	9,68 99	9,74 94	10,25 06	9,94 05	41	
29	20	9,69 01	9,74 97	10,25 03	9,94 04	40	60
	21	9,69 03	9,75 00	10,25 00	9,94 03	39	
	22	9,69 05	9,75 03	10,24 97	9,94 03	38	
	23	9,69 08	9,75 06	10,24 94	9,94 02	37	
	24	9,69 10	9,75 09	10,24 91	9,94 01	36	
	25	9,69 12	9,75 12	10,24 88	9,94 00	35	
	26	9,69 14	9,75 15	10,24 85	9,94 00	34	
	27	9,69 17	9,75 18	10,24 82	9,93 99	33	
	28	9,69 19	9,75 20	10,24 79	9,93 98	32	
	29	9,69 21	9,75 23	10,24 76	9,93 98	31	
29	30	9,69 23	9,75 26	10,24 74	9,93 97	30	60
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
29	30	9,69 23	9,75 26	10,24 74	9,93 97	30	60
	31	9,69 26	9,75 29	10,24 71	9,93 96	29	
	32	9,69 28	9,75 32	10,24 68	9,93 95	28	
	33	9,69 30	9,75 35	10,24 65	9,93 95	27	
	34	9,69 32	9,75 38	10,24 62	9,93 94	26	
	35	9,69 34	9,75 41	10,24 59	9,93 93	25	
	36	9,69 37	9,75 44	10,24 56	9,93 93	24	
	37	9,69 39	9,75 47	10,24 53	9,93 92	23	
	38	9,69 41	9,75 50	10,24 50	9,93 91	22	
	39	9,69 43	9,75 53	10,24 47	9,93 90	21	
29	40	9,69 46	9,75 56	10,24 44	9,93 90	20	60
	41	9,69 48	9,75 59	10,24 41	9,93 89	19	
	42	9,69 50	9,75 62	10,24 38	9,93 88	18	
	43	9,69 52	9,75 65	10,24 35	9,93 88	17	
	44	9,69 54	9,75 68	10,24 32	9,93 87	16	
	45	9,69 57	9,75 70	10,24 29	9,93 86	15	
	46	9,69 59	9,75 73	10,24 26	9,93 85	14	
	47	9,69 61	9,75 76	10,24 24	9,93 85	13	
	48	9,69 63	9,75 79	10,24 21	9,93 84	12	
	49	9,69 65	9,75 82	10,24 18	9,93 83	11	
29	50	9,69 68	9,75 85	10,24 15	9,93 83	10	60
	51	9,69 70	9,75 88	10,24 12	9,93 82	9	
	52	9,69 72	9,75 91	10,24 09	9,93 81	8	
	53	9,69 74	9,75 94	10,24 06	9,93 80	7	
	54	9,69 76	9,75 97	10,24 03	9,93 80	6	
	55	9,69 79	9,76 00	10,24 00	9,93 79	5	
	56	9,69 81	9,76 03	10,23 97	9,93 78	4	
	57	9,69 83	9,76 06	10,23 94	9,93 77	3	
	58	9,69 85	9,76 09	10,23 91	9,93 77	2	
	59	9,69 87	9,76 11	10,23 88	9,93 76	1	
30	0	9,69 90	9,76 14	10,23 86	9,93 75	0	60
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

M.	log sin.	log tang.	log cotg.	log cos.	′	°
0	9,69 90	9,76 14	10,23 86	9,93 75	**0**	**60**
1	9,69 92	9,76 17	10,23 83	9,93 75	59	
2	9,69 94	9,76 20	10,23 80	9,93 74	58	
3	9,69 96	9,76 23	10,23 77	9,93 73	57	
4	9,69 98	9,76 26	10,23 74	9,93 72	56	
5	9,70 01	9,76 29	10,23 71	9,93 72	55	
6	9,70 03	9,76 32	10,23 68	9,93 71	54	
7	9,70 05	9,76 35	10,23 65	9,93 70	53	
8	9,70 07	9,76 38	10,23 62	9,93 69	52	
9	9,70 09	9,76 41	10,23 59	9,93 69	51	
10	9,70 11	9,76 43	10,23 56	9,93 68	**50**	**59**
11	9,70 14	9,76 46	10,23 54	9,93 67	49	
12	9,70 16	9,76 49	10,23 51	9,93 66	48	
13	9,70 18	9,76 52	10,23 48	9,93 66	47	
14	9,70 20	9,76 55	10,23 45	9,93 65	46	
15	9,70 22	9,76 58	10,23 42	9,93 64	45	
16	9,70 24	9,76 61	10,23 39	9,93 64	44	
17	9,70 27	9,76 64	10,23 36	9,93 63	43	
18	9,70 29	9,76 67	10,23 33	9,93 62	42	
19	9,70 31	9,76 70	10,23 30	9,93 61	41	
20	9,70 33	9,76 72	10,23 27	9,93 61	**40**	**59**
21	9,70 35	9,76 75	10,23 25	9,93 60	39	
22	9,70 37	9,76 78	10,23 22	9,93 59	38	
23	9,70 40	9,76 81	10,23 19	9,93 58	37	
24	9,70 42	9,76 84	10,23 16	9,93 58	36	
25	9,70 44	9,76 87	10,23 13	9,93 57	35	
26	9,70 46	9,76 90	10,23 10	9,93 56	34	
27	9,70 48	9,76 93	10,23 07	9,93 55	33	
28	9,70 50	9,76 96	10,23 04	9,93 55	32	
29	9,70 52	9,76 99	10,23 01	9,93 54	31	
30	9,70 55	9,77 01	10,22 98	9,93 53	**30**	**59**
	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
30	30	9,70 55	9,77 01	10,22 98	9,93 53	30	59
	31	9,70 57	9,77 04	10,22 96	9,93 52	29	
	32	9,70 59	9,77 07	10,22 93	9,93 52	28	
	33	9,70 61	9,77 10	10,22 90	9,93 51	27	
	34	9,70 63	9,77 13	10,22 87	9,93 50	26	
	35	9,70 65	9,77 16	10,22 84	9,93 49	25	
	36	9,70 67	9,77 19	10,22 81	9,93 49	24	
	37	9,70 70	9,77 22	10,22 78	9,93 48	23	
	38	9,70 72	9,77 25	10,22 75	9,93 47	22	
	39	9,70 74	9,77 27	10,22 73	9,93 46	21	
30	40	9,70 76	9,77 30	10,22 70	9,93 46	20	59
	41	9,70 78	9,77 33	10,22 67	9,93 45	19	
	42	9,70 80	9,77 36	10,22 64	9,93 44	18	
	43	9,70 82	9,77 39	10,22 61	9,93 43	17	
	44	9,70 85	9,77 42	10,22 58	9,93 43	16	
	45	9,70 87	9,77 45	10,22 55	9,93 42	15	
	46	9,70 89	9,77 48	10,22 52	9,93 41	14	
	47	9,70 91	9,77 50	10,22 49	9,93 40	13	
	48	9,70 93	9,77 53	10,22 47	9,93 40	12	
	49	9,70 95	9,77 56	10,22 44	9,93 39	11	
30	50	9,70 97	9,77 59	10,22 41	9,93 38	10	59
	51	9,70 99	9,77 62	10,22 38	9,93 37	9	
	52	9,71 01	9,77 65	10,22 35	9,93 37	8	
	53	9,71 04	9,77 68	10,22 32	9,93 36	7	
	54	9,71 06	9,77 71	10,22 29	9,93 35	6	
	55	9,71 08	9,77 73	10,22 27	9,93 34	5	
	56	9,71 10	9,77 76	10,22 24	9,93 34	4	
	57	9,71 12	9,77 79	10,22 21	9,93 33	3	
	58	9,71 14	9,77 82	10,22 18	9,93 32	2	
	59	9,71 16	9,77 85	10,22 15	9,93 31	1	
31	0	9,71 18	9,77 88	10,22 12	9,93 31	0	59
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

g tang.	log cotg.	log cos.	′	°
,77 88	10,22 12	9,93 31	0	59
,77 91	10,22 09	9,93 30	59	
,77 93	10,22 06	9,93 29	58	
,77 96	10,22 04	9,93 28	57	
,77 99	10,22 01	9,93 28	56	
,78 02	10,21 98	9,93 27	55	
,78 05	10,21 95	9,93 26	54	
,78 08	10,21 92	9,93 25	53	
,78 11	10,21 89	9,93 25	52	
,78 13	10,21 86	9,93 24	51	
,78 16	10,21 84	9,93 23	50	58
,78 19	10,21 81	9,93 22	49	
,78 22	10,21 78	9,93 21	48	
,78 25	10,21 75	9,93 21	47	
,78 28	10,21 72	9,93 20	46	
,78 31	10,21 69	9,93 19	45	
,78 33	10,21 67	9,93 18	44	
,78 36	10,21 64	9,93 18	43	
,78 39	10,21 61	9,93 17	42	
,78 42	10,21 58	9,93 16	41	
,78 45	10,21 55	9,93 15	40	58
,78 48	10,21 52	9,93 15	39	
,78 50	10,21 49	9,93 14	38	
,78 53	10,21 47	9,93 13	37	
,78 56	10,21 44	9,93 12	36	
,78 59	10,21 41	9,93 11	35	
,78 62	10,21 38	9,93 11	34	
,78 65	10,21 35	9,93 10	33	
,78 67	10,21 32	9,93 09	32	
,78 70	10,21 30	9,93 08	31	
,78 73	10,21 27	9,93 08	30	58
g cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	″
31	30	9,71 81	9,78 73	10,21 27	9,93 08	30	58
	31	9,71 83	9,78 76	10,21 24	9,93 07	29	
	32	9,71 85	9,78 79	10,21 21	9,93 06	28	
	33	9,71 87	9,78 82	10,21 18	9,93 05	27	
	34	9,71 89	9,78 84	10,21 15	9,93 05	26	
	35	9,71 91	9,78 87	10,21 13	9,93 04	25	
	36	9,71 93	9,78 90	10,21 10	9,93 03	24	
	37	9,71 95	9,78 93	10,21 07	9,93 02	23	
	38	9,71 97	9,78 96	10,21 04	9,93 01	22	
	39	9,71 99	9,78 99	10,21 01	9,93 01	21	
31	40	9,72 01	9,79 01	10,20 98	9,93 00	20	58
	41	9,72 03	9,79 04	10,20 96	9,92 99	19	
	42	9,72 05	9,79 07	10,20 93	9,92 98	18	
	43	9,72 07	9,79 10	10,20 90	9,92 98	17	
	44	9,72 10	9,79 13	10,20 87	9,92 97	16	
	45	9,72 12	9,79 16	10,20 84	9,92 96	15	
	46	9,72 14	9,79 18	10,20 81	9,92 95	14	
	47	9,72 16	9,79 21	10,20 79	9,92 94	13	
	48	9,72 18	9,79 24	10,20 76	9,92 94	12	
	49	9,72 20	9,79 27	10,20 73	9,92 93	11	
31	50	9,72 22	9,79 30	10,20 70	9,92 92	10	58
	51	9,72 24	9,79 33	10,20 67	9,92 91	9	
	52	9,72 26	9,79 35	10,20 65	9,92 90	8	
	53	9,72 28	9,79 38	10,20 62	9,92 90	7	
	54	9,72 30	9,79 41	10,20 59	9,92 89	6	
	55	9,72 32	9,79 44	10,20 56	9,92 88	5	
	56	9,72 34	9,79 47	10,20 53	9,92 87	4	
	57	9,72 36	9,79 49	10,20 50	9,92 87	3	
	58	9,72 38	9,79 52	10,20 48	9,92 86	2	
	59	9,72 40	9,79 55	10,20 45	9,92 85	1	
32	0	9,72 42	9,79 58	10,20 42	9,92 84	0	58
	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
32	0	9,72 42	9,79 58	10,20 42	9,92 84	0	58
	1	9,72 44	9,79 61	10,20 39	9,92 83	59	
	2	9,72 46	9,79 63	10,20 36	9,92 83	58	
	3	9,72 48	9,79 66	10,20 34	9,92 82	57	
	4	9,72 50	9,79 69	10,20 31	9,92 81	56	
	5	9,72 52	9,79 72	10,20 28	9,92 80	55	
	6	9,72 54	9,79 75	10,20 25	9,92 79	54	
	7	9,72 56	9,79 78	10,20 22	9,92 79	53	
	8	9,72 58	9,79 80	10,20 20	9,92 78	52	
	9	9,72 60	9,79 83	10,20 17	9,92 77	51	
32	10	9,72 62	9,79 86	10,20 14	9,92 76	50	57
	11	9,72 64	9,79 89	10,20 11	9,92 75	49	
	12	9,72 66	9,79 92	10,20 08	9,92 75	48	
	13	9,72 68	9,79 94	10,20 06	9,92 74	47	
	14	9,72 70	9,79 97	10,20 03	9,92 73	46	
	15	9,72 72	9,80 00	10,20 00	9,92 72	45	
	16	9,72 74	9,80 03	10,19 97	9,92 71	44	
	17	9,72 76	9,80 06	10,19 94	9,92 71	43	
	18	9,72 78	9,80 08	10,19 92	9,92 70	42	
	19	9,72 80	9,80 11	10,19 89	9,92 69	41	
32	20	9,72 82	9,80 14	10,19 86	9,92 68	40	57
	21	9,72 84	9,80 17	10,19 83	9,92 67	39	
	22	9,72 86	9,80 19	10,19 80	9,92 67	38	
	23	9,72 88	9,80 22	10,19 78	9,92 66	37	
	24	9,72 90	9,80 25	10,19 75	9,92 65	36	
	25	9,72 92	9,80 28	10,19 72	9,92 64	35	
	26	9,72 94	9,80 31	10,19 69	9,92 63	34	
	27	9,72 96	9,80 33	10,19 66	9,92 63	33	
	28	9,72 98	9,80 36	10,19 64	9,92 62	32	
	29	9,73 00	9,80 39	10,19 61	9,92 61	31	
32	30	9,73 02	9,80 42	10,19 58	9,92 60	30	57
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	″
32	30	9,73 02	9,80 42	10,19 58	9,92 60	30	57
	31	9,73 04	9,80 45	10,19 55	9,92 59	29	
	32	9,73 06	9,80 47	10,19 53	9,92 59	28	
	33	9,73 08	9,80 50	10,19 50	9,92 58	27	
	34	9,73 10	9,80 53	10,19 47	9,92 57	26	
	35	9,73 12	9,80 56	10,19 44	9,92 56	25	
	36	9,73 14	9,80 59	10,19 41	9,92 55	24	
	37	9,73 16	9,80 61	10,19 39	9,92 55	23	
	38	9,73 18	9,80 64	10,19 36	9,92 54	22	
	39	9,73 20	9,80 67	10,19 33	9,92 53	21	
32	40	9,73 22	9,80 70	10,19 30	9,92 52	20	57
	41	9,73 24	9,80 72	10,19 27	9,92 51	19	
	42	9,73 26	9,80 75	10,19 25	9,92 51	18	
	43	9,73 28	9,80 78	10,19 22	9,92 50	17	
	44	9,73 30	9,80 81	10,19 19	9,92 49	16	
	45	9,73 32	9,80 84	10,19 16	9,92 48	15	
	46	9,73 34	9,80 86	10,19 14	9,92 47	14	
	47	9,73 36	9,80 89	10,19 11	9,92 46	13	
	48	9,73 38	9,80 92	10,19 08	9,92 46	12	
	49	9,73 40	9,80 95	10,19 05	9,92 45	11	
32	50	9,73 42	9,80 97	10,19 02	9,92 44	10	57
	51	9,73 43	9,81 00	10,19 00	9,92 43	9	
	52	9,73 45	9,81 03	10,18 97	9,92 42	8	
	53	9,73 47	9,81 06	10,18 94	9,92 42	7	
	54	9,73 49	9,81 09	10,18 91	9,92 41	6	
	55	9,73 51	9,81 11	10,18 89	9,92 40	5	
	56	9,73 53	9,81 14	10,18 86	9,92 39	4	
	57	9,73 55	9,81 17	10,18 83	9,92 38	3	
	58	9,73 57	9,81 20	10,18 80	9,92 38	2	
	59	9,73 59	9,81 22	10,18 78	9,92 37	1	
33	0	9,73 61	9,81 25	10,18 75	9,92 36	0	57
″	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
33	0	9,73 61	9,81 25	10,18 75	9,92 36	0	57
	1	9,73 63	9,81 28	10,18 72	9,92 35	59	
	2	9,73 65	9,81 31	10,18 69	9,92 34	58	
	3	9,73 67	9,81 33	10,18 66	9,92 33	57	
	4	9,73 69	9,81 36	10,18 64	9,92 33	56	
	5	9,73 71	9,81 39	10,18 61	9,92 32	55	
	6	9,73 73	9,81 42	10,18 58	9,92 31	54	
	7	9,73 75	9,81 44	10,18 55	9,92 30	53	
	8	9,73 77	9,81 47	10,18 53	9,92 29	52	
	9	9,73 78	9,81 50	10,18 50	9,92 28	51	
33	10	9,73 80	9,81 53	10,18 47	9,92 28	50	56
	11	9,73 82	9,81 56	10,18 44	9,92 27	49	
	12	9,73 84	9,81 58	10,18 42	9,92 26	48	
	13	9,73 86	9,81 61	10,18 39	9,92 25	47	
	14	9,73 88	9,81 64	10,18 36	9,92 24	46	
	15	9,73 90	9,81 67	10,18 33	9,92 23	45	
	16	9,73 92	9,81 69	10,18 31	9,92 23	44	
	17	9,73 94	9,81 72	10,18 28	9,92 22	43	
	18	9,73 96	9,81 75	10,18 25	9,92 21	42	
	19	9,73 98	9,81 78	10,18 22	9,92 20	41	
33	20	9,74 00	9,81 80	10,18 20	9,92 19	40	56
	21	9,74 02	9,81 83	10,18 17	9,92 19	39	
	22	9,74 04	9,81 86	10,18 14	9,92 18	38	
	23	9,74 05	9,81 89	10,18 11	9,92 17	37	
	24	9,74 07	9,81 91	10,18 09	9,92 16	36	
	25	9,74 09	9,81 94	10,18 06	9,92 15	35	
	26	9,74 11	9,81 97	10,18 03	9,92 14	34	
	27	9,74 13	9,82 00	10,18 00	9,92 14	33	
	28	9,74 15	9,82 02	10,17 98	9,92 13	32	
	29	9,74 17	9,82 05	10,17 95	9,92 12	31	
33	30	9,74 19	9,82 08	10,17 92	9,92 11	30	56
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
33	30	9,74 19	9,82 08	10,17 92	9,92 11	30	56
	31	9,74 21	9,82 11	10,17 89	9,92 10	29	
	32	9,74 23	9,82 13	10,17 87	9,92 09	28	
	33	9,74 25	9,82 16	10,17 84	9,92 09	27	
	34	9,74 26	9,82 19	10,17 81	9,92 08	26	
	35	9,74 28	9,82 21	10,17 78	9,92 07	25	
	36	9,74 30	9,82 24	10,17 76	9,92 06	24	
	37	9,74 32	9,82 27	10,17 73	9,92 05	23	
	38	9,74 34	9,82 30	10,17 70	9,92 04	22	
	39	9,74 36	9,82 32	10,17 67	9,92 03	21	
33	40	9,74 38	9,82 35	10,17 65	9,92 03	20	56
	41	9,74 40	9,82 38	10,17 62	9,92 02	19	
	42	9,74 42	9,82 41	10,17 59	9,92 01	18	
	43	9,74 44	9,82 43	10,17 56	9,92 00	17	
	44	9,74 45	9,82 46	10,17 54	9,91 99	16	
	45	9,74 47	9,82 49	10,17 51	9,91 98	15	
	46	9,74 49	9,82 52	10,17 48	9,91 98	14	
	47	9,74 51	9,82 54	10,17 46	9,91 97	13	
	48	9,74 53	9,82 57	10,17 43	9,91 96	12	
	49	9,74 55	9,82 60	10,17 40	9,91 95	11	
33	50	9,74 57	9,82 63	10,17 37	9,91 94	10	56
	51	9,74 59	9,82 65	10,17 35	9,91 93	9	
	52	9,74 61	9,82 68	10,17 32	9,91 92	8	
	53	9,74 62	9,82 71	10,17 29	9,91 92	7	
	54	9,74 64	9,82 73	10,17 26	9,91 91	6	
	55	9,74 66	9,82 76	10,17 24	9,91 90	5	
	56	9,74 68	9,82 79	10,17 21	9,91 89	4	
	57	9,74 70	9,82 82	10,17 18	9,91 88	3	
	58	9,74 72	9,82 84	10,17 16	9,91 87	2	
	59	9,74 74	9,82 87	10,17 13	9,91 87	1	
34	0	9,74 76	9,82 90	10,17 10	9,91 86	0	56
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
34	0	9,74 76	9,82 90	10,17 10	9,91 86	0	56
	1	9,74 77	9,82 93	10,17 07	9,91 85	59	
	2	9,74 79	9,82 95	10,17 05	9,91 84	58	
	3	9,74 81	9,82 98	10,17 02	9,91 83	57	
	4	9,74 83	9,83 01	10,16 99	9,91 82	56	
	5	9,74 85	9,83 03	10,16 96	9,91 81	55	
	6	9,74 87	9,83 06	10,16 94	9,91 81	54	
	7	9,74 89	9,83 09	10,16 91	9,91 80	53	
	8	9,74 91	9,83 12	10,16 88	9,91 79	52	
	9	9,74 92	9,83 14	10,16 86	9,91 78	51	
34	10	9,74 94	9,83 17	10,16 83	9,91 77	50	55
	11	9,74 96	9,83 20	10,16 80	9,91 76	49	
	12	9,74 98	9,83 22	10,16 77	9,91 75	48	
	13	9,75 00	9,83 25	10,16 75	9,91 75	47	
	14	9,75 02	9,83 28	10,16 72	9,91 74	46	
	15	9,75 04	9,83 31	10,16 69	9,91 73	45	
	16	9,75 05	9,83 33	10,16 67	9,91 72	44	
	17	9,75 07	9,83 36	10,16 64	9,91 71	43	
	18	9,75 09	9,83 39	10,16 61	9,91 70	42	
	19	9,75 11	9,83 41	10,16 58	9,91 69	41	
34	20	9,75 13	9,83 44	10,16 56	9,91 69	40	55
	21	9,75 15	9,83 47	10,16 53	9,91 68	39	
	22	9,75 16	9,83 50	10,16 50	9,91 67	38	
	23	9,75 18	9,83 52	10,16 48	9,91 66	37	
	24	9,75 20	9,83 55	10,16 45	9,91 65	36	
	25	9,75 22	9,83 58	10,16 42	9,91 64	35	
	26	9,75 24	9,83 60	10,16 39	9,91 63	34	
	27	9,75 26	9,83 63	10,16 37	9,91 62	33	
	28	9,75 28	9,83 66	10,16 34	9,91 62	32	
	29	9,75 29	9,83 69	10,16 31	9,91 61	31	
34	30	9,75 31	9,83 71	10,16 29	9,91 60	30	55
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	″
34	30	9,75 31	9,83 71	10,16 29	9,91 60	30	55
	31	9,75 33	9,83 74	10,16 26	9,91 59	29	
	32	9,75 35	9,83 77	10,16 23	9,91 58	28	
	33	9,75 37	9,83 79	10,16 20	9,91 57	27	
	34	9,75 39	9,83 82	10,16 18	9,91 56	26	
	35	9,75 40	9,83 85	10,16 15	9,91 56	25	
	36	9,75 42	9,83 88	10,16 12	9,91 55	24	
	37	9,75 44	9,83 90	10,16 10	9,91 54	23	
	38	9,75 46	9,83 93	10,16 07	9,91 53	22	
	39	9,75 48	9,83 96	10,16 04	9,91 52	21	
34	40	9,75 50	9,83 98	10,16 02	9,91 51	20	55
	41	9,75 51	9,84 01	10,15 99	9,91 50	19	
	42	9,75 53	9,84 04	10,15 96	9,91 49	18	
	43	9,75 55	9,84 06	10,15 93	9,91 49	17	
	44	9,75 57	9,84 09	10,15 91	9,91 48	16	
	45	9,75 59	9,84 12	10,15 88	9,91 47	15	
	46	9,75 60	9,84 15	10,15 85	9,91 46	14	
	47	9,75 62	9,84 17	10,15 83	9,91 45	13	
	48	9,75 64	9,84 20	10,15 80	9,91 44	12	
	49	9,75 66	9,84 23	10,15 77	9,91 43	11	
34	50	9,75 68	9,84 25	10,15 75	9,91 42	10	55
	51	9,75 70	9,84 28	10,15 72	9,91 42	9	
	52	9,75 71	9,84 31	10,15 69	9,91 41	8	
	53	9,75 73	9,84 33	10,15 67	9,91 40	7	
	54	9,75 75	9,84 36	10,15 64	9,91 39	6	
	55	9,75 77	9,84 39	10,15 61	9,91 38	5	
	56	9,75 79	9,84 41	10,15 58	9,91 37	4	
	57	9,75 80	9,84 44	10,15 56	9,91 36	3	
	58	9,75 82	9,84 47	10,15 53	9,91 35	2	
	59	9,75 84	9,84 50	10,15 50	9,91 34	1	
35	0	9,75 86	9,84 52	10,15 48	9,91 34	0	5
	′	log cos.	log cotg.	log tang.	log sin.	M.	D

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
35	0	9,75 86	9,84 52	10,15 48	9,91 34	0	55
	1	9,75 88	9,84 55	10,15 45	9,91 33	59	
	2	9,75 89	9,84 58	10,15 42	9,91 32	58	
	3	9,75 91	9,84 60	10,15 40	9,91 31	57	
	4	9,75 93	9,84 63	10,15 37	9,91 30	56	
	5	9,75 95	9,84 66	10,15 34	9,91 29	55	
	6	9,75 97	9,84 68	10,15 32	9,91 28	54	
	7	9,75 98	9,84 71	10,15 29	9,91 27	53	
	8	9,76 00	9,84 74	10,15 26	9,91 27	52	
	9	9,76 02	9,84 76	10,15 24	9,91 26	51	
35	10	9,76 04	9,84 79	10,15 21	9,91 25	50	54
	11	9,76 06	9,84 82	10,15 18	9,91 24	49	
	12	9,76 07	9,84 84	10,15 15	9,91 23	48	
	13	9,76 09	9,84 87	10,15 13	9,91 22	47	
	14	9,76 11	9,84 90	10,15 10	9,91 21	46	
	15	9,76 13	9,84 92	10,15 07	9,91 20	45	
	16	9,76 15	9,84 95	10,15 05	9,91 19	44	
	17	9,76 16	9,84 98	10,15 02	9,91 18	43	
	18	9,76 18	9,85 01	10,14 99	9,91 18	42	
	19	9,76 20	9,85 03	10,14 97	9,91 17	41	
35	20	9,76 22	9,85 06	10,14 94	9,91 16	40	54
	21	9,76 24	9,85 09	10,14 91	9,91 15	39	
	22	9,76 25	9,85 11	10,14 89	9,91 14	38	
	23	9,76 27	9,85 14	10,14 86	9,91 13	37	
	24	9,76 29	9,85 17	10,14 83	9,91 12	36	
	25	9,76 31	9,85 19	10,14 81	9,91 11	35	
	26	9,76 32	9,85 22	10,14 78	9,91 10	34	
	27	9,76 34	9,85 25	10,14 75	9,91 10	33	
	28	9,76 36	9,85 27	10,14 73	9,91 09	32	
	29	9,76 38	9,85 30	10,14 70	9,91 08	31	
35	30	9,76 39	9,85 33	10,14 67	9,91 07	30	54
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	″
30	30	9,70 55	9,77 01	10,22 98	9,93 53	30	59
	31	9,70 57	9,77 04	10,22 96	9,93 52	29	
	32	9,70 59	9,77 07	10,22 93	9,93 52	28	
	33	9,70 61	9,77 10	10,22 90	9,93 51	27	
	34	9,70 63	9,77 13	10,22 87	9,93 50	26	
	35	9,70 65	9,77 16	10,22 84	9,93 49	25	
	36	9,70 67	9,77 19	10,22 81	9,93 49	24	
	37	9,70 70	9,77 22	10,22 78	9,93 48	23	
	38	9,70 72	9,77 25	10,22 75	9,93 47	22	
	39	9,70 74	9,77 27	10,22 73	9,93 46	21	
30	40	9,70 76	9,77 30	10,22 70	9,93 46	20	59
	41	9,70 78	9,77 33	10,22 67	9,93 45	19	
	42	9,70 80	9,77 36	10,22 64	9,93 44	18	
	43	9,70 82	9,77 39	10,22 61	9,93 43	17	
	44	9,70 85	9,77 42	10,22 58	9,93 43	16	
	45	9,70 87	9,77 45	10,22 55	9,93 42	15	
	46	9,70 89	9,77 48	10,22 52	9,93 41	14	
	47	9,70 91	9,77 50	10,22 49	9,93 40	13	
	48	9,70 93	9,77 53	10,22 47	9,93 40	12	
	49	9,70 95	9,77 56	10,22 44	9,93 39	11	
30	50	9,70 97	9,77 59	10,22 41	9,93 38	10	59
	51	9,70 99	9,77 62	10,22 38	9,93 37	9	
	52	9,71 01	9,77 65	10,22 35	9,93 37	8	
	53	9,71 04	9,77 68	10,22 32	9,93 36	7	
	54	9,71 06	9,77 71	10,22 29	9,93 35	6	
	55	9,71 08	9,77 73	10,22 27	9,93 34	5	
	56	9,71 10	9,77 76	10,22 24	9,93 34	4	
	57	9,71 12	9,77 79	10,22 21	9,93 33	3	
	58	9,71 14	9,77 82	10,22 18	9,93 32	2	
	59	9,71 16	9,77 85	10,22 15	9,93 31	1	
31	0	9,71 18	9,77 88	10,22 12	9,93 31	0	59
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
36	0	9,76 92	9,86 13	10,13 87	9,90 80	0	54
	1	9,76 94	9,86 15	10,13 85	9,90 79	59	
	2	9,76 96	9,86 18	10,13 82	9,90 78	58	
	3	9,76 97	9,86 21	10,13 79	9,90 77	57	
	4	9,76 99	9,86 23	10,13 77	9,90 76	56	
	5	9,77 01	9,86 26	10,13 74	9,90 75	55	
	6	9,77 03	9,86 28	10,13 71	9,90 74	54	
	7	9,77 04	9,86 31	10,13 69	9,90 73	53	
	8	9,77 06	9,86 34	10,13 66	9,90 72	52	
	9	9,77 08	9,86 36	10,13 63	9,90 71	51	
36	10	9,77 09	9,86 39	10,13 61	9,90 70	50	53
	11	9,77 11	9,86 42	10,13 58	9,90 69	49	
	12	9,77 13	9,86 44	10,13 55	9,90 68	48	
	13	9,77 15	9,86 47	10,13 53	9,90 68	47	
	14	9,77 16	9,86 50	10,13 50	9,90 67	46	
	15	9,77 18	9,86 52	10,13 48	9,90 66	45	
	16	9,77 20	9,86 55	10,13 45	9,90 65	44	
	17	9,77 22	9,86 58	10,13 42	9,90 64	43	
	18	9,77 23	9,86 60	10,13 40	9,90 63	42	
	19	9,77 25	9,86 63	10,13 37	9,90 62	41	
36	20	9,77 27	9,86 66	10,13 34	9,90 61	40	53
	21	9,77 28	9,86 68	10,13 32	9,90 60	39	
	22	9,77 30	9,86 71	10,13 29	9,90 59	38	
	23	9,77 32	9,86 74	10,13 26	9,90 58	37	
	24	9,77 34	9,86 76	10,13 24	9,90 57	36	
	25	9,77 35	9,86 79	10,13 21	9,90 56	35	
	26	9,77 37	9,86 81	10,13 18	9,90 55	34	
	27	9,77 39	9,86 84	10,13 16	9,90 55	33	
	28	9,77 40	9,86 87	10,13 13	9,90 54	32	
	29	9,77 42	9,86 89	10,13 11	9,90 53	31	
36	30	9,77 44	9,86 92	10,13 08	9,90 52	30	53
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	″
31	30	9,71 81	9,78 73	10,21 27	9,93 18	30	58
	31	9,71 83	9,78 76	10,21 24	9,93 17	29	
	32	9,71 85	9,78 79	10,21 21	9,93 16	28	
	33	9,71 87	9,78 82	10,21 18	9,93 15	27	
	34	9,71 89	9,78 84	10,21 15	9,93 15	26	
	35	9,71 91	9,78 87	10,21 13	9,93 14	25	
	36	9,71 93	9,78 90	10,21 10	9,93 13	24	
	37	9,71 95	9,78 93	10,21 07	9,93 12	23	
	38	9,71 97	9,78 96	10,21 04	9,93 11	22	
	39	9,71 99	9,78 99	10,21 01	9,93 11	21	
31	40	9,72 01	9,79 01	10,20 98	9,93 10	20	58
	41	9,72 03	9,79 04	10,20 96	9,92 99	19	
	42	9,72 05	9,79 07	10,20 93	9,92 98	18	
	43	9,72 07	9,79 10	10,20 90	9,92 98	17	
	44	9,72 10	9,79 13	10,20 87	9,92 97	16	
	45	9,72 12	9,79 16	10,20 84	9,92 96	15	
	46	9,72 14	9,79 18	10,20 81	9,92 95	14	
	47	9,72 16	9,79 21	10,20 79	9,92 94	13	
	48	9,72 18	9,79 24	10,20 76	9,92 94	12	
	49	9,72 20	9,79 27	10,20 73	9,92 93	11	
31	50	9,72 22	9,79 30	10,20 70	9,92 92	10	58
	51	9,72 24	9,79 33	10,20 67	9,92 91	9	
	52	9,72 26	9,79 35	10,20 65	9,92 90	8	
	53	9,72 28	9,79 38	10,20 62	9,92 90	7	
	54	9,72 30	9,79 41	10,20 59	9,92 89	6	
	55	9,72 32	9,79 44	10,20 56	9,92 88	5	
	56	9,72 34	9,79 47	10,20 53	9,92 87	4	
	57	9,72 36	9,79 49	10,20 50	9,92 87	3	
	58	9,72 38	9,79 52	10,20 48	9,92 86	2	
	59	9,72 40	9,79 55	10,20 45	9,92 85	1	
32	0	9,72 42	9,79 58	10,20 42	9,92 84	0	58
″	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
32	0	9,72 42	9,79 58	10,20 42	9,92 84	0	58
	1	9,72 44	9,79 61	10,20 39	9,92 83	59	
	2	9,72 46	9,79 63	10,20 36	9,92 83	58	
	3	9,72 48	9,79 66	10,20 34	9,92 82	57	
	4	9,72 50	9,79 69	10,20 31	9,92 81	56	
	5	9,72 52	9,79 72	10,20 28	9,92 80	55	
	6	9,72 54	9,79 75	10,20 25	9,92 79	54	
	7	9,72 56	9,79 78	10,20 22	9,92 79	53	
	8	9,72 58	9,79 80	10,20 20	9,92 78	52	
	9	9,72 60	9,79 83	10,20 17	9,92 77	51	
32	10	9,72 62	9,79 86	10,20 14	9,92 76	50	57
	11	9,72 64	9,79 89	10,20 11	9,92 75	49	
	12	9,72 66	9,79 92	10,20 08	9,92 75	48	
	13	9,72 68	9,79 94	10,20 06	9,92 74	47	
	14	9,72 70	9,79 97	10,20 03	9,92 73	46	
	15	9,72 72	9,80 00	10,20 00	9,92 72	45	
	16	9,72 74	9,80 03	10,19 97	9,92 71	44	
	17	9,72 76	9,80 06	10,19 94	9,92 71	43	
	18	9,72 78	9,80 08	10,19 92	9,92 70	42	
	19	9,72 80	9,80 11	10,19 89	9,92 69	41	
32	20	9,72 82	9,80 14	10,19 86	9,92 68	40	57
	21	9,72 84	9,80 17	10,19 83	9,92 67	39	
	22	9,72 86	9,80 19	10,19 80	9,92 67	38	
	23	9,72 88	9,80 22	10,19 78	9,92 66	37	
	24	9,72 90	9,80 25	10,19 75	9,92 65	36	
	25	9,72 92	9,80 28	10,19 72	9,92 64	35	
	26	9,72 94	9,80 31	10,19 69	9,92 63	34	
	27	9,72 96	9,80 33	10,19 66	9,92 63	33	
	28	9,72 98	9,80 36	10,19 64	9,92 62	32	
	29	9,73 00	9,80 39	10,19 61	9,92 61	31	
32	30	9,73 02	9,80 42	10,19 58	9,92 60	30	57
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	″
37	30	9,78 44	9,88 50	10,11 50	9,89 95	30	52
	31	9,78 46	9,88 52	10,11 48	9,89 94	29	
	32	9,78 48	9,88 55	10,11 45	9,89 93	28	
	33	9,78 49	9,88 58	10,11 42	9,89 92	27	
	34	9,78 51	9,88 60	10,11 40	9,89 91	26	
	35	9,78 53	9,88 63	10,11 37	9,89 90	25	
	36	9,78 54	9,88 65	10,11 34	9,89 89	24	
	37	9,78 56	9,88 68	10,11 32	9,89 88	23	
	38	9,78 58	9,88 71	10,11 29	9,89 87	22	
	39	9,78 59	9,88 73	10,11 27	9,89 86	21	
37	40	9,78 61	9,88 76	10,11 24	9,89 85	20	52
	41	9,78 62	9,88 79	10,11 21	9,89 84	19	
	42	9,78 64	9,88 81	10,11 19	9,89 83	18	
	43	9,78 66	9,88 84	10,11 16	9,89 82	17	
	44	9,78 67	9,88 86	10,11 14	9,89 81	16	
	45	9,78 69	9,88 89	10,11 11	9,89 80	15	
	46	9,78 71	9,88 92	10,11 08	9,89 79	14	
	47	9,78 72	9,88 94	10,11 06	9,89 78	13	
	48	9,78 74	9,88 97	10,11 03	9,89 77	12	
	49	9,78 76	9,88 99	10,11 01	9,89 76	11	
37	50	9,78 77	9,89 02	10,10 98	9,89 75	10	52
	51	9,78 79	9,89 05	10,10 95	9,89 74	9	
	52	9,78 80	9,89 07	10,10 93	9,89 73	8	
	53	9,78 82	9,89 10	10,10 90	9,89 72	7	
	54	9,78 84	9,89 12	10,10 87	9,89 71	6	
	55	9,78 85	9,89 15	10,10 85	9,89 70	5	
	56	9,78 87	9,89 18	10,10 82	9,89 69	4	
	57	9,78 89	9,89 20	10,10 80	9,89 68	3	
	58	9,78 90	9,89 23	10,10 77	9,89 67	2	
	59	9,78 92	9,89 25	10,10 74	9,89 66	1	
38	0	9,78 93	9,89 28	10,10 72	9,89 65	0	52
″	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
38	0	9,78 93	9,89 28	10,10 72	9,89 65	0	52
	1	9,78 95	9,89 31	10,10 69	9,89 64	59	
	2	9,78 97	9,89 33	10,10 67	9,89 63	58	
	3	9,78 98	9,89 36	10,10 64	9,89 62	57	
	4	9,79 00	9,89 38	10,10 61	9,89 61	56	
	5	9,79 01	9,89 41	10,10 59	9,89 60	55	
	6	9,79 03	9,89 44	10,10 56	9,89 59	54	
	7	9,79 05	9,89 46	10,10 54	9,89 58	53	
	8	9,79 06	9,89 49	10,10 51	9,89 57	52	
	9	9,79 08	9,89 51	10,10 48	9,89 56	51	
38	10	9,79 09	9,89 54	10,10 46	9,89 55	50	51
	11	9,79 11	9,89 57	10,10 43	9,89 54	49	
	12	9,79 13	9,89 59	10,10 41	9,89 53	48	
	13	9,79 14	9,89 62	10,10 38	9,89 52	47	
	14	9,79 16	9,89 64	10,10 35	9,89 51	46	
	15	9,79 18	9,89 67	10,10 33	9,89 50	45	
	16	9,79 19	9,89 70	10,10 30	9,89 49	44	
	17	9,79 21	9,89 72	10,10 28	9,89 48	43	
	18	9,79 22	9,89 75	10,10 25	9,89 47	42	
	19	9,79 24	9,89 77	10,10 22	9,89 46	41	
38	20	9,79 26	9,89 80	10,10 20	9,89 45	40	51
	21	9,79 27	9,89 83	10,10 17	9,89 44	39	
	22	9,79 29	9,89 85	10,10 15	9,89 43	38	
	23	9,79 30	9,89 88	10,10 12	9,89 42	37	
	24	9,79 32	9,89 90	10,10 09	9,89 41	36	
	25	9,79 33	9,89 93	10,10 07	9,89 40	35	
	26	9,79 35	9,89 96	10,10 04	9,89 39	34	
	27	9,79 37	9,89 98	10,10 02	9,89 38	33	
	28	9,79 38	9,90 01	10,09 99	9,89 37	32	
	29	9,79 40	9,90 03	10,09 96	9,89 36	31	
38	30	9,79 41	9,90 06	10,09 94	9,89 35	30	51
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
38	30	9,79 41	9,90 06	10,09 94	9,89 35	30	51
	31	9,79 43	9,90 09	10,09 91	9,89 34	29	
	32	9,79 45	9,90 11	10,09 89	9,89 33	28	
	33	9,79 46	9,90 14	10,09 86	9,89 32	27	
	34	9,79 48	9,90 16	10,09 84	9,89 31	26	
	35	9,79 49	9,90 19	10,09 81	9,89 30	25	
	36	9,79 51	9,90 22	10,09 78	9,89 29	24	
	37	9,79 53	9,90 24	10,09 76	9,89 28	23	
	38	9,79 54	9,90 27	10,09 73	9,89 27	22	
	39	9,79 56	9,90 29	10,09 71	9,89 26	21	
38	40	9,79 57	9,90 32	10,09 68	9,89 25	20	51
	41	9,79 59	9,90 35	10,09 65	9,89 24	19	
	42	9,79 60	9,90 37	10,09 63	9,89 23	18	
	43	9,79 62	9,90 40	10,09 60	9,89 22	17	
	44	9,79 64	9,90 42	10,09 58	9,89 21	16	
	45	9,79 65	9,90 45	10,09 55	9,89 20	15	
	46	9,79 67	9,90 47	10,09 52	9,89 19	14	
	47	9,79 68	9,90 50	10,09 50	9,89 18	13	
	48	9,79 70	9,90 53	10,09 47	9,89 17	12	
	49	9,79 71	9,90 55	10,09 45	9,89 16	11	
38	50	9,79 73	9,90 58	10,09 42	9,89 15	10	51
	51	9,79 75	9,90 60	10,09 40	9,89 14	9	
	52	9,79 76	9,90 63	10,09 37	9,89 13	8	
	53	9,79 78	9,90 66	10,09 34	9,89 12	7	
	54	9,79 79	9,90 68	10,09 32	9,89 11	6	
	55	9,79 81	9,90 71	10,09 29	9,89 10	5	
	56	9,79 82	9,90 73	10,09 27	9,89 09	4	
	57	9,79 84	9,90 76	10,09 24	9,89 08	3	
	58	9,79 86	9,90 78	10,09 21	9,89 07	2	
	59	9,79 87	9,90 81	10,09 19	9,89 06	1	
39	0	9,79 89	9,90 84	10,09 16	9,89 05	0	51
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

in.	log tang.	log cotg.	log cos.	′	°
89	9,90 84	10,09 16	9,89 05	**0**	**51**
90	9,90 86	10,09 14	9,89 04	59	
92	9,90 89	10,09 11	9,89 03	58	
93	9,90 91	10,09 09	9,89 02	57	
95	9,90 94	10,09 06	9,89 01	56	
96	9,90 97	10,09 03	9,89 00	55	
98	9,90 99	10,09 01	9,88 99	54	
00	9,91 02	10,08 98	9,88 98	53	
01	9,91 04	10,08 96	9,88 97	52	
03	9,91 07	10,08 93	9,88 96	51	
04	9,91 09	10,08 90	9,88 95	**50**	**50**
06	9,91 12	10,08 88	9,88 94	49	
07	9,91 15	10,08 85	9,88 93	48	
09	9,91 17	10,08 83	9,88 92	47	
10	9,91 20	10,08 80	9,88 91	46	
12	9,91 22	10,08 78	9,88 90	45	
14	9,91 25	10,08 75	9,88 89	44	
15	9,91 28	10,08 72	9,88 87	43	
17	9,91 30	10,08 70	9,88 86	42	
18	9,91 33	10,08 67	9,88 85	41	
20	9,91 35	10,08 65	9,88 84	**40**	**50**
21	9,91 38	10,08 62	9,88 83	39	
23	9,91 40	10,08 60	9,88 82	38	
24	9,91 43	10,08 57	9,88 81	37	
26	9,91 46	10,08 54	9,88 80	36	
27	9,91 48	10,08 52	9,88 79	35	
29	9,91 51	10,08 49	9,88 78	34	
30	9,91 53	10,08 47	9,88 77	33	
32	9,91 56	10,08 44	9,88 76	32	
34	9,91 58	10,08 41	9,88 75	31	
35	9,91 61	10,08 39	9,88 74	**30**	**50**
os.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
39	30	9,80 35	9,91 61	10,08 39	9,88 74	30	50
	31	9,80 37	9,91 64	10,08 36	9,88 73	29	
	32	9,80 38	9,91 66	10,08 34	9,88 72	28	
	33	9,80 40	9,91 69	10,08 31	9,88 71	27	
	34	9,80 41	9,91 71	10,08 29	9,88 70	26	
	35	9,80 43	9,91 74	10,08 26	9,88 69	25	
	36	9,80 44	9,91 76	10,08 23	9,88 68	24	
	37	9,80 46	9,91 79	10,08 21	9,88 67	23	
	38	9,80 47	9,91 82	10,08 18	9,88 66	22	
	39	9,80 49	9,91 84	10,08 16	9,88 65	21	
39	40	9,80 50	9,91 87	10,08 13	9,88 64	20	50
	41	9,80 52	9,91 89	10,08 11	9,88 63	19	
	42	9,80 53	9,91 92	10,08 08	9,88 61	18	
	43	9,80 55	9,91 94	10,08 05	9,88 60	17	
	44	9,80 56	9,91 97	10,08 03	9,88 59	16	
	45	9,80 58	9,92 00	10,08 00	9,88 58	15	
	46	9,80 59	9,92 02	10,07 98	9,88 57	14	
	47	9,80 61	9,92 05	10,07 95	9,88 56	13	
	48	9,80 62	9,92 07	10,07 93	9,88 55	12	
	49	9,80 64	9,92 10	10,07 90	9,88 54	11	
39	50	9,80 66	9,92 12	10,07 87	9,88 53	10	50
	51	9,80 67	9,92 15	10,07 85	9,88 52	9	
	52	9,80 69	9,92 18	10,07 82	9,88 51	8	
	53	9,80 70	9,92 20	10,07 80	9,88 50	7	
	54	9,80 72	9,92 23	10,07 77	9,88 49	6	
	55	9,80 73	9,92 25	10,07 75	9,88 48	5	
	56	9,80 75	9,92 28	10,07 72	9,88 47	4	
	57	9,80 76	9,92 30	10,07 70	9,88 46	3	
	58	9,80 78	9,92 33	10,07 67	9,88 45	2	
	59	9,80 79	9,92 36	10,07 64	9,88 44	1	
40	0	9,80 81	9,92 38	10,07 62	9,88 42	0	50
	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
40	0	9,80 81	9,92 38	10,07 62	9,88 42	0	50
	1	9,80 82	9,92 41	10,07 59	9,88 41	59	
	2	9,80 84	9,92 43	10,07 57	9,88 40	58	
	3	9,80 85	9,92 46	10,07 54	9,88 39	57	
	4	9,80 87	9,92 48	10,07 52	9,88 38	56	
	5	9,80 88	9,92 51	10,07 49	9,88 37	55	
	6	9,80 90	9,92 53	10,07 46	9,88 36	54	
	7	9,80 91	9,92 56	10,07 44	9,88 35	53	
	8	9,80 93	9,92 59	10,07 41	9,88 34	52	
	9	9,80 94	9,92 61	10,07 39	9,88 33	51	
40	10	9,80 96	9,92 64	10,07 36	9,88 32	50	49
	11	9,80 97	9,92 66	10,07 34	9,88 31	49	
	12	9,80 99	9,92 69	10,07 31	9,88 30	48	
	13	9,81 00	9,92 71	10,07 28	9,88 29	47	
	14	9,81 02	9,92 74	10,07 26	9,88 28	46	
	15	9,81 03	9,92 77	10,07 23	9,88 27	45	
	16	9,81 05	9,92 79	10,07 21	9,88 25	44	
	17	9,81 06	9,92 82	10,07 18	9,88 24	43	
	18	9,81 08	9,92 84	10,07 16	9,88 23	42	
	19	9,81 09	9,92 87	10,07 13	9,88 22	41	
40	20	9,81 11	9,92 89	10,07 11	9,88 21	40	49
	21	9,81 12	9,92 92	10,07 08	9,88 20	39	
	22	9,81 14	9,92 94	10,07 05	9,88 19	38	
	23	9,81 15	9,92 97	10,07 03	9,88 18	37	
	24	9,81 17	9,93 00	10,07 00	9,88 17	36	
	25	9,81 18	9,93 02	10,06 98	9,88 16	35	
	26	9,81 19	9,93 05	10,06 95	9,88 15	34	
	27	9,81 21	9,93 07	10,06 93	9,88 14	33	
	28	9,81 22	9,93 10	10,06 90	9,88 13	32	
	29	9,81 24	9,93 12	10,06 88	9,88 11	31	
40	30	9,81 25	9,93 15	10,06 85	9,88 10	30	49
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	″
40	30	9,81 25	9,93 15	10,06 85	9,88 10	30	49
	31	9,81 27	9,93 17	10,06 82	9,88 09	29	
	32	9,81 28	9,93 20	10,06 80	9,88 08	28	
	33	9,81 30	9,93 23	10,06 77	9,88 07	27	
	34	9,81 31	9,93 25	10,06 75	9,88 06	26	
	35	9,81 33	9,93 28	10,06 72	9,88 05	25	
	36	9,81 34	9,93 30	10,06 70	9,88 04	24	
	37	9,81 36	9,93 33	10,06 67	9,88 03	23	
	38	9,81 37	9,93 35	10,06 65	9,88 02	22	
	39	9,81 39	9,93 38	10,06 62	9,88 01	21	
40	40	9,81 40	9,93 41	10,06 59	9,88 00	20	49
	41	9,81 42	9,93 43	10,06 57	9,87 98	19	
	42	9,81 43	9,93 46	10,06 54	9,87 97	18	
	43	9,81 45	9,93 48	10,06 52	9,87 96	17	
	44	9,81 46	9,93 51	10,06 49	9,87 95	16	
	45	9,81 47	9,93 53	10,06 47	9,87 94	15	
	46	9,81 49	9,93 56	10,06 44	9,87 93	14	
	47	9,81 50	9,93 58	10,06 42	9,87 92	13	
	48	9,81 52	9,93 61	10,06 39	9,87 91	12	
	49	9,81 53	9,93 64	10,06 36	9,87 90	11	
40	50	9,81 55	9,93 66	10,06 34	9,87 89	10	49
	51	9,81 56	9,93 69	10,06 31	9,87 88	9	
	52	9,81 58	9,93 71	10,06 29	9,87 87	8	
	53	9,81 59	9,93 74	10,06 26	9,87 85	7	
	54	9,81 61	9,93 76	10,06 24	9,87 84	6	
	55	9,81 62	9,93 79	10,06 21	9,87 83	5	
	56	9,81 64	9,93 81	10,06 19	9,87 82	4	
	57	9,81 65	9,93 84	10,06 16	9,87 81	3	
	58	9,81 66	9,93 86	10,06 13	9,87 80	2	
	59	9,81 68	9,93 89	10,06 11	9,87 79	1	
41	0	9,81 69	9,93 92	10,06 08	9,87 78	0	49
	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
41	**0**	9,81 69	9,93 92	10,06 08	9,87 78	**0**	49
	1	9,81 71	9,93 94	10,06 06	9,87 77	59	
	2	9,81 72	9,93 97	10,06 03	9,87 76	58	
	3	9,81 74	9,93 99	10,06 01	9,87 74	57	
	4	9,81 75	9,94 02	10,05 98	9,87 73	56	
	5	9,81 77	9,94 04	10,05 96	9,87 72	55	
	6	9,81 78	9,94 07	10,05 93	9,87 71	54	
	7	9,81 80	9,94 09	10,05 90	9,87 70	53	
	8	9,81 81	9,94 12	10,05 88	9,87 69	52	
	9	9,81 82	9,94 15	10,05 85	9,87 68	51	
41	**10**	9,81 84	9,94 17	10,05 83	9,87 67	**50**	48
	11	9,81 85	9,94 20	10,05 80	9,87 66	49	
	12	9,81 87	9,94 22	10,05 78	9,87 65	48	
	13	9,81 88	9,94 25	10,05 75	9,87 63	47	
	14	9,81 90	9,94 27	10,05 73	9,87 62	46	
	15	9,81 91	9,94 30	10,05 70	9,87 61	45	
	16	9,81 93	9,94 32	10,05 68	9,87 60	44	
	17	9,81 94	9,94 35	10,05 65	9,87 59	43	
	18	9,81 95	9,94 37	10,05 62	9,87 58	42	
	19	9,81 97	9,94 40	10,05 60	9,87 57	41	
41	**20**	9,81 98	9,94 43	10,05 57	9,87 56	**40**	48
	21	9,82 00	9,94 45	10,05 55	9,87 55	39	
	22	9,82 01	9,94 48	10,05 52	9,87 53	38	
	23	9,82 03	9,94 50	10,05 50	9,87 52	37	
	24	9,82 04	9,94 53	10,05 47	9,87 51	36	
	25	9,82 05	9,94 55	10,05 45	9,87 50	35	
	26	9,82 07	9,94 58	10,05 42	9,87 49	34	
	27	9,82 08	9,94 60	10,05 40	9,87 48	33	
	28	9,82 10	9,94 63	10,05 37	9,87 47	32	
	29	9,82 11	9,94 65	10,05 34	9,87 46	31	
41	**30**	9,82 13	9,94 68	10,05 32	9,87 45	**30**	48
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
41	30	9,82 13	9,94 68	10,05 32	9,87 45	30	48
	31	9,82 14	9,94 71	10,05 29	9,87 43	29	
	32	9,82 15	9,94 73	10,05 27	9,87 42	28	
	33	9,82 17	9,94 76	10,05 24	9,87 41	27	
	34	9,82 18	9,94 78	10,05 22	9,87 40	26	
	35	9,82 20	9,94 81	10,05 19	9,87 39	25	
	36	9,82 21	9,94 83	10,05 17	9,87 38	24	
	37	9,82 23	9,94 86	10,05 14	9,87 37	23	
	38	9,82 24	9,94 88	10,05 12	9,87 36	22	
	39	9,82 25	9,94 91	10,05 09	9,87 34	21	
41	40	9,82 27	9,94 93	10,05 06	9,87 33	20	48
	41	9,82 28	9,94 96	10,05 04	9,87 32	19	
	42	9,82 30	9,94 99	10,05 01	9,87 31	18	
	43	9,82 31	9,95 01	10,04 99	9,87 30	17	
	44	9,82 33	9,95 04	10,04 96	9,87 29	16	
	45	9,82 34	9,95 06	10,04 94	9,87 28	15	
	46	9,82 35	9,95 09	10,04 91	9,87 27	14	
	47	9,82 37	9,95 11	10,04 89	9,87 25	13	
	48	9,82 38	9,95 14	10,04 86	9,87 24	12	
	49	9,82 40	9,95 16	10,04 84	9,87 23	11	
41	50	9,82 41	9,95 19	10,04 81	9,87 22	10	48
	51	9,82 42	9,95 21	10,04 78	9,87 21	9	
	52	9,82 44	9,95 24	10,04 76	9,87 20	8	
	53	9,82 45	9,95 27	10,04 73	9,87 19	7	
	54	9,82 47	9,95 29	10,04 71	9,87 17	6	
	55	9,82 48	9,95 32	10,04 68	9,87 16	5	
	56	9,82 49	9,95 34	10,04 66	9,87 15	4	
	57	9,82 51	9,95 37	10,04 63	9,87 14	3	
	58	9,82 52	9,95 39	10,04 61	9,87 13	2	
	59	9,82 54	9,95 42	10,04 58	9,87 12	1	
42	0	9,82 55	9,95 44	10,04 56	9,87 11	0	48
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

M.	log sin.	log tang.	log cotg.	log cos.	′	°
0	9,82 55	9,95 44	10,04 56	9,87 11	**0**	**48**
1	9,82 56	9,95 47	10,04 53	9,87 10	59	
2	9,82 58	9,95 49	10,04 50	9,87 08	58	
3	9,82 59	9,95 52	10,04 48	9,87 07	57	
4	9,82 61	9,95 54	10,04 45	9,87 06	56	
5	9,82 62	9,95 57	10,04 43	9,87 05	55	
6	9,82 63	9,95 60	10,04 40	9,87 04	54	
7	9,82 65	9,95 62	10,04 38	9,87 03	53	
8	9,82 66	9,95 65	10,04 35	9,87 02	52	
9	9,82 68	9,95 67	10,04 33	9,87 00	51	
10	9,82 69	9,95 70	10,04 30	9,86 99	**50**	**47**
11	9,82 70	9,95 72	10,04 28	9,86 98	49	
12	9,82 72	9,95 75	10,04 25	9,86 97	48	
13	9,82 73	9,95 77	10,04 23	9,86 96	47	
14	9,82 75	9,95 80	10,04 20	9,86 95	46	
15	9,82 76	9,95 82	10,04 17	9,86 94	45	
16	9,82 77	9,95 85	10,04 15	9,86 92	44	
17	9,82 79	9,95 87	10,04 12	9,86 91	43	
18	9,82 80	9,95 90	10,04 10	9,86 90	42	
19	9,82 82	9,95 93	10,04 07	9,86 89	41	
20	9,82 83	9,95 95	10,04 05	9,86 88	**40**	**47**
21	9,82 84	9,95 98	10,04 02	9,86 87	39	
22	9,82 86	9,96 00	10,04 00	9,86 85	38	
23	9,82 87	9,96 03	10,03 97	9,86 84	37	
24	9,82 88	9,96 05	10,03 95	9,86 83	36	
25	9,82 90	9,96 08	10,03 92	9,86 82	35	
26	9,82 91	9,96 10	10,03 90	9,86 81	34	
27	9,82 93	9,96 13	10,03 87	9,86 80	33	
28	9,82 94	9,96 15	10,03 84	9,86 79	32	
29	9,82 95	9,96 18	10,03 82	9,86 77	31	
30	9,82 97	9,96 20	10,03 79	9,86 76	**30**	**47**
′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.
42	30	9,82 97	9,96 20	10,03 79	9,86 76
	31	9,82 98	9,96 23	10,03 77	9,86 75
	32	9,83 00	9,96 26	10,03 74	9,86 74
	33	9,83 01	9,96 28	10,03 72	9,86 73
	34	9,83 02	9,96 31	10,03 69	9,86 72
	35	9,83 04	9,96 33	10,03 67	9,86 70
	36	9,83 05	9,96 36	10,03 64	9,86 69
	37	9,83 06	9,96 38	10,03 62	9,86 68
	38	9,83 08	9,96 41	10,03 59	9,86 67
	39	9,83 09	9,96 43	10,03 57	9,86 66
42	40	9,83 11	9,96 46	10,03 54	9,86 65
	41	9,83 12	9,96 48	10,03 52	9,86 63
	42	9,83 13	9,96 51	10,03 49	9,86 62
	43	9,83 15	9,96 53	10,03 46	9,86 61
	44	9,83 16	9,96 56	10,03 44	9,86 60
	45	9,83 17	9,96 59	10,03 41	9,86 59
	46	9,83 19	9,96 61	10,03 39	9,86 58
	47	9,83 20	9,96 64	10,03 36	9,86 56
	48	9,83 21	9,96 66	10,03 34	9,86 55
	49	9,83 23	9,96 69	10,03 31	9,86 54
42	50	9,83 24	9,96 71	10,03 29	9,86 53
	51	9,83 26	9,96 74	10,03 26	9,86 52
	52	9,83 27	9,96 76	10,03 24	9,86 51
	53	9,83 28	9,96 79	10,03 21	9,86 49
	54	9,83 30	9,96 81	10,03 19	9,86 48
	55	9,83 31	9,96 84	10,03 16	9,86 47
	56	9,83 32	9,96 86	10,03 14	9,86 46
	57	9,83 34	9,96 89	10,03 11	9,86 45
	58	9,83 35	9,96 91	10,03 08	9,86 44
	59	9,83 36	9,96 94	10,03 06	9,86 42
43	0	9,83 38	9,96 97	10,03 03	9,86 41
°	′	log cos.	log cotg.	log tang.	log sin.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
43	0	9,83 38	9,96 97	10,03 03	9,86 41	0	47
	1	9,83 39	9,96 99	10,03 01	9,86 40	59	
	2	9,83 40	9,97 02	10,02 98	9,86 39	58	
	3	9,83 42	9,97 04	10,02 96	9,86 38	57	
	4	9,83 43	9,97 07	10,02 93	9,86 37	56	
	5	9,83 45	9,97 09	10,02 91	9,86 35	55	
	6	9,83 46	9,97 12	10,02 88	9,86 34	54	
	7	9,83 47	9,97 14	10,02 86	9,86 33	53	
	8	9,83 49	9,97 17	10,02 83	9,86 32	52	
	9	9,83 50	9,97 19	10,02 81	9,86 31	51	
43	10	9,83 51	9,97 22	10,02 78	9,86 29	50	46
	11	9,83 53	9,97 24	10,02 76	9,86 28	49	
	12	9,83 54	9,97 27	10,02 73	9,86 27	48	
	13	9,83 55	9,97 29	10,02 70	9,86 26	47	
	14	9,83 57	9,97 32	10,02 68	9,86 25	46	
	15	9,83 58	9,97 34	10,02 65	9,86 23	45	
	16	9,83 59	9,97 37	10,02 63	9,86 22	44	
	17	9,83 61	9,97 40	10,02 60	9,86 21	43	
	18	9,83 62	9,97 42	10,02 58	9,86 20	42	
	19	9,83 63	9,97 45	10,02 55	9,86 19	41	
43	20	9,83 65	9,97 47	10,02 53	9,86 18	40	46
	21	9,83 66	9,97 50	10,02 50	9,86 16	39	
	22	9,83 67	9,97 52	10,02 48	9,86 15	38	
	23	9,83 69	9,97 55	10,02 45	9,86 14	37	
	24	9,83 70	9,97 57	10,02 43	9,86 13	36	
	25	9,83 71	9,97 60	10,02 40	9,86 12	35	
	26	9,83 73	9,97 62	10,02 38	9,86 10	34	
	27	9,83 74	9,97 65	10,02 35	9,86 09	33	
	28	9,83 75	9,97 67	10,02 33	9,86 08	32	
	29	9,83 77	9,97 70	10,02 30	9,86 07	31	
43	30	9,83 78	9,97 72	10,02 27	9,86 06	30	46
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
43	30	9,83 78	9,97 72	10,02 27	9,86 06	30	46
	31	9,83 79	9,97 75	10,02 25	9,86 04	29	
	32	9,83 81	9,97 78	10,02 22	9,86 03	28	
	33	9,83 82	9,97 80	10,02 20	9,86 02	27	
	34	9,83 83	9,97 83	10,02 17	9,86 01	26	
	35	9,83 85	9,97 85	10,02 15	9,86 00	25	
	36	9,83 86	9,97 88	10,02 12	9,85 98	24	
	37	9,83 87	9,97 90	10,02 10	9,85 97	23	
	38	9,83 89	9,97 93	10,02 07	9,85 96	22	
	39	9,83 90	9,97 95	10,02 05	9,85 95	21	
43	40	9,83 91	9,97 98	10,02 02	9,85 94	20	46
	41	9,83 93	9,98 00	10,02 00	9,85 92	19	
	42	9,83 94	9,98 03	10,01 97	9,85 91	18	
	43	9,83 95	9,98 05	10,01 95	9,85 90	17	
	44	9,83 97	9,98 08	10,01 92	9,85 89	16	
	45	9,83 98	9,98 10	10,01 90	9,85 88	15	
	46	9,83 99	9,98 13	10,01 87	9,85 86	14	
	47	9,84 01	9,98 15	10,01 84	9,85 85	13	
	48	9,84 02	9,98 18	10,01 82	9,85 84	12	
	49	9,84 03	9,98 21	10,01 79	9,85 83	11	
43	50	9,84 05	9,98 23	10,01 77	9,85 81	10	46
	51	9,84 06	9,98 26	10,01 74	9,85 80	9	
	52	9,84 07	9,98 28	10,01 72	9,85 79	8	
	53	9,84 08	9,98 31	10,01 69	9,85 78	7	
	54	9,84 10	9,98 33	10,01 67	9,85 77	6	
	55	9,84 11	9,98 36	10,01 64	9,85 75	5	
	56	9,84 12	9,98 38	10,01 62	9,85 74	4	
	57	9,84 14	9,98 41	10,01 59	9,85 73	3	
	58	9,84 15	9,98 43	10,01 57	9,85 72	2	
	59	9,84 16	9,98 46	10,01 54	9,85 71	1	
44	0	9,84 18	9,98 48	10,01 52	9,85 69	0	46
°	′	log cos.	log cotg.	log tang.	log sin.	M.	D.

D.	M.	log sin.	log tang.	log cotg.	log cos.	′	°
44	0	9,84 18	9,98 48	10,01 52	9,85 69	0	46
	1	9,84 19	9,98 51	10,01 49	9,85 68	59	
	2	9,84 20	9,98 53	10,01 47	9,85 67	58	
	3	9,84 22	9,98 56	10,01 44	9,85 66	57	
	4	9,84 23	9,98 58	10,01 41	9,85 64	56	
	5	9,84 24	9,98 61	10,01 39	9,85 63	55	
	6	9,84 25	9,98 63	10,01 36	9,85 62	54	
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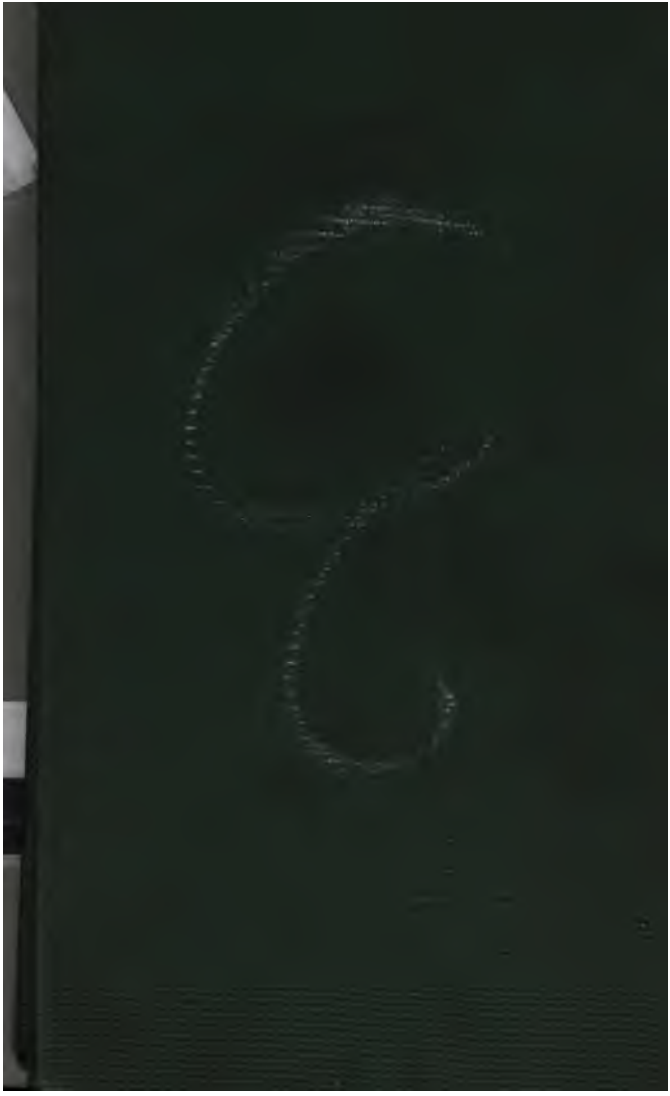
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